Understanding Bowel Cancer Screening Intention across different populations: Identifying Predictors of Bowel Screening Interventions.

Soumya Shetty
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I confirm that the work submitted is my own and that appropriate credit has been given where reference has been made to the work of others.

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हे नाथ नारायण िासुदेिा ॥

Praise to God who is all
truth, all consciousness and
all bliss.

Abstract

Bowel cancer is the third leading cause of cancer-related mortality globally. Screening enables early detection and significantly reduces mortality; however, uptake remains low, particularly among individuals from diverse backgrounds. Understanding psychosocial determinants of screening and evaluating intervention strategies is therefore essential to inform effective screening policies.

This mixed-methods PhD thesis aimed to: (1) explore barriers and facilitators of bowel cancer screening; (2) identify psychological predictors of screening intention and behaviour; and (3) evaluate the effectiveness of existing screening interventions to inform effective public health strategies.

The thesis comprised two systematic reviews and two empirical studies. Study 1 used qualitative interviews across India and the UK (N = 30) to explore screening beliefs, analysed using reflexive thematic analysis. Chapter 4 presented a systematic review of 84 studies investigating psychosocial predictors of intention and behaviour. Study 2 was a large cross-sectional survey (N = 2,000) conducted across India and the UK using Protection Motivation Theory (PMT) constructs. Chapter 6 synthesised 119 studies to evaluate strategies to increase screening uptake.

Study 1 identified key barriers including lack of awareness, negative attitudes towards healthcare, and socioeconomic constraints, while social support and health literacy facilitated participation. Chapter 4 found self-efficacy ($r = .16$), response efficacy ($r = .15$), and perceived benefits ($r = .18$) were the strongest predictors of intention, while perceived barriers negatively predicted uptake ($r = –.12$). Study 2 confirmed self-efficacy ($\beta = .31$), knowledge ($\beta = .22$), and response efficacy ($\beta = .19$) significantly predicted intention. Chapter 6 showed interventions increased uptake (OR = 1.46, 95% CI [1.32, 1.61]); mailed FIT kits (OR = 2.10) and patient navigation (OR = 1.84) were most effective, with no significant differences between White and Non-White groups.

Psychological determinants and structural barriers jointly influence screening intention. Theoretically grounded interventions improve uptake effectively.

List of Abbreviations

Abbreviation	**Full Term**
BC	Bowel Cancer
CRC	Colorectal Cancer
NHS	National Health Service
ICS	Indian Cancer Society
SES	Socioeconomic Status
HIC	High-Income Country
LMIC	Low- and Middle-Income Country
PMT	Protection Motivation Theory
HBM	Health Belief Model
TPB	Theory of Planned Behaviour
RCT	Randomised Controlled Trial
OR	Odds Ratio
CI	Confidence Interval
k	Number of Effect Sizes/Contrasts
N	Sample Size
UK	United Kingdom
FOBT	Faecal Occult Blood Test
gFOBT	Guaiac Faecal Occult Blood Test
FIT	Faecal Immunochemical Test
FS	Flexible Sigmoidoscopy
QoL	Quality of Life
GP	General Practitioner
BCT	Behaviour Change Technique
SPSS	Statistical Package for the Social Sciences
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	International Prospective Register of Systematic Reviews
CMA	Comprehensive Meta-Analysis (software)
SD	Standard Deviation

SE	Standard Error
α	Cronbach’s Alpha (internal consistency)
r	Correlation Coefficient
β	Standardised Beta Coefficient
I^2	Heterogeneity Statistic
Q	Cochran’s Q (heterogeneity test)
R^2	Explained Variance
CI	Confidence Interval
DV	Dependent Variable
IV	Independent Variable
AOR	Adjusted Odds Ratio
ROR	Ratio of Odds Ratios
ns	Non-significant
p	Probability Value
IBM	International Business Machines (SPSS distributor)
TTM	Transtheoretical Model
PAPM	Precaution Adoption Process Model
i-SAM	Integrated Screening Action Model

Publications and presentations

Publications

Soumya Shetty, Mark Conner and Chris Keyworth. (2025). Understanding Bowel Cancer Screening Intention and Behaviour across British, Indian, and Indian-Immigrant populations: A qualitative cross-cultural comparison. Manuscript under review; submitted July 2025.

Presented as Study 1 (Chapter 4) within this Thesis.

Presentations

Soumya Shetty, Mark Conner and Chris Keyworth. (2025). Understanding Bowel Cancer Screening Intention and Behaviour across British, Indian, and Indian-Immigrant populations: A qualitative cross-cultural comparison. Talk Presented at the BPS Qualitative Methods in Psychology Conference.

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Shetty, S. (2025). Understanding Bowel Cancer Screening Intention and Behaviour across different populations: Identifying Predictors of Bowel Cancer Screening Intention and investigating Bowel Cancer Screening Interventions. Presentation delivered at the Cambridge University at the Early Cancer Symposium.

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Chapter 1

Thesis Overview: Thesis objectives, theoretical background and study overview

1.1 Chapter summary

This chapter outlines the structure of the current thesis, and the rationale for each included studies in the present PhD research. The chapter begins by outlining the thesis objectives and how each study aligns with them. Additionally, this chapter outlines the different theoretical frameworks that have guided this thesis and the studies within it. This chapter concludes with an overview of the individual studies and a description of how these studies are interconnected. This is a mixed-methods PhD project.

1.2 Problem Statement

Bowel cancer screening is a proven and effective strategy for reducing cancer-related mortality through early detection and effective treatment. Despite the availability of organised screening programmes across many countries, uptake of bowel cancer screening remains suboptimal, particularly among individuals from socioeconomically disadvantaged, ethnic minority, and migrant backgrounds. These disparities contribute to late diagnoses, poorer outcomes, higher burden on the patient as well as the healthcare system and widening health inequalities across populations.

Existing literature has identified a range of psychosocial, cultural, and structural factors associated with bowel cancer screening intention and behaviour. However, much of the research is focused on single populations, isolated predictors, or individual intervention strategies. There is a lack of integrative, theory-driven research that simultaneously examines psychosocial predictors of screening intention and behaviour alongside the effectiveness of interventions designed to improve uptake across diverse population groups.

Furthermore, although behavioural theories have been widely applied to understand health behaviours, there remains limited empirical synthesis linking theoretically derived predictors to intervention components in the context of bowel cancer screening. This gap restricts the ability of policymakers and healthcare providers to design interventions that are both theoretically informed and responsive to the needs of diverse populations.

Addressing these limitations is essential to improving screening participation and reducing inequalities in bowel cancer outcomes. The present thesis responds to this gap by adopting a mixed-methods, theory-driven approach to examine barriers, facilitators, psychosocial predictors, and intervention effectiveness across different populations and healthcare contexts.

1.3 Thesis objectives

The overall aim of this thesis is to understand barriers and facilitators of bowel cancer screening across different groups, to identify and examine the predictors of bowel cancer screening across different groups and to evaluate the current bowel cancer screening interventions to identify ways to make them more effective in terms of boosting bowel cancer screening participation rates across different groups.

This thesis utilises various cross-cultural studies and systematic reviews to examine these aims and to meet the thesis objectives.

The specific objectives of this thesis were to (refer to Figure 1.1 below for a quick overview):

1. Identify and examine the barriers and facilitators of bowel cancer screening across different groups:

    - A qualitative cross-cultural comparison aimed at understanding bowel cancer screening intention and behaviour across British, Indian, and Indian-Immigrant populations.

2. Identify and examine psychosocial variables of bowel cancer screening intention across different groups:

    - A systematic review to synthesise existing evidence on psychosocial variables associated with bowel cancer screening and to examine these variables across different groups.

- A cross-sectional survey-based study aimed at examining how these variables operate across different settings and their relationship with bowel cancer screening intention across different groups.

3. Examine the effectiveness of existing bowel cancer screening interventions across different groups and to inform how these interventions can be made more inclusive.

- A systematic review to evaluate the effectiveness of existing bowel cancer screening interventions across different groups and to inform recommendations for interventions to improve uptake.

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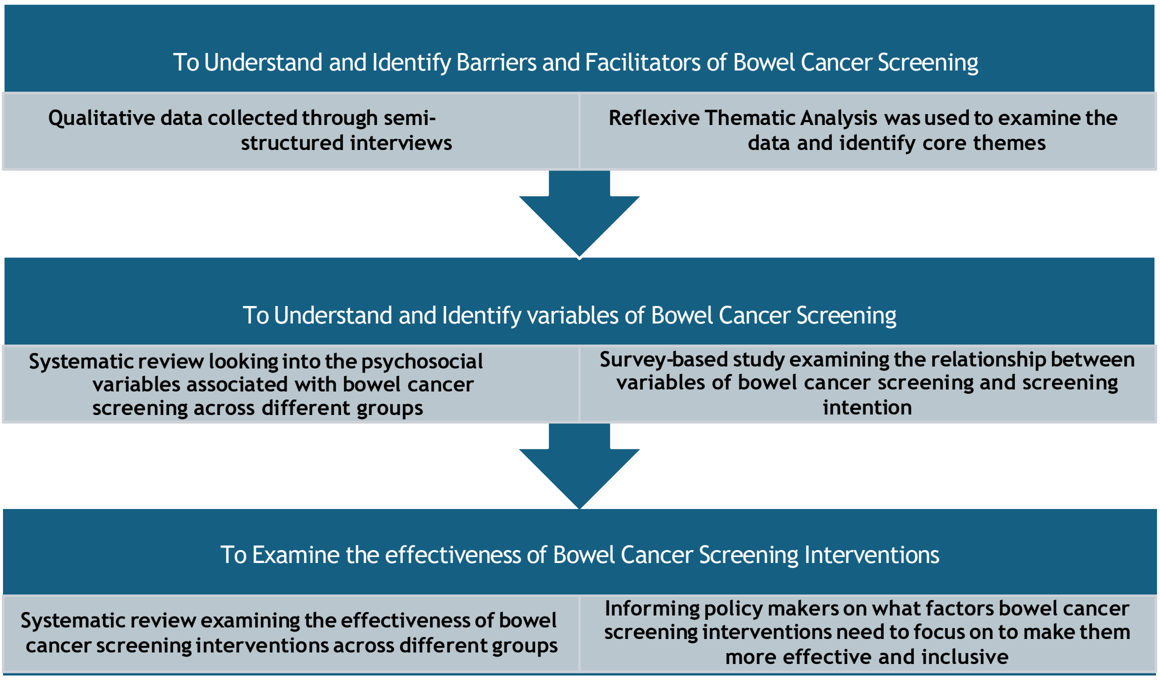

Figure 1.1. Thesis outline

1.4 Theoretical Framework

Health Behaviour Change Models

Health behaviour models have been used to understand bowel cancer screening intention and behaviour, the prominent models within this framework are the Health Belief Model (HBM; Becker et al, 1974), Theory of Reasoned Action (Fishbein & Ajzen, 1975) and Theory of Planned Behaviour (Ajzen, 1991). This framework suggests that cognitive factors, such as attitudes, beliefs, values, and perceptions of health are determinants of behaviour, via behavioural intention. According to the

Health Belief Model, cognitive factors such as high perceived benefits and low perceived barriers have been found to impact bowel cancer screening uptake across different settings (Almadi et al., 2015; Lau et al., 2020; McCaffery, 2000). In a systematic review of 21 studies, it was found that HBM constructs such as perceived susceptibility (*OR* 1.40, 95% *CI* [1.03–1.89]), perceived benefits (*OR* 1.30; 95% *CI* [1.13–1.50]), and self- efficacy (*OR* 1.11; 95% *CI* [1.05–1.17]) were significantly associated with both the uptake of and intention to adopt preventive measures against cervical cancer (Al-Ani et al., 2023). The theory of planned behaviour (TPB) proposes a model to understand how human behaviour operates; It is used to predict the occurrence of a specific action under the circumstance that the action is intentional, the theory proposes that behaviour has three key determinants: overall evaluation of the behaviour (attitudes), estimate of the social pressure (social norms) and beliefs about the ability to perform the behaviour (perceived behavioural control) (Ajzen, 1991). Studies have found that TPB can predict intentions to attend cancer screening and actual attendance behaviour well, with a medium-sized to a large-sized association for different constructs (Cooke et al., 2008; Sieverding et al., 2010). In a study with patients from Federally Qualified Health Centres applied the TPB constructs to screening behaviours, it was found that attitudes towards bowel cancer screening impacted actual uptake (Arnold et al., 2017). In addition to these models, Protection Motivation Theory (Rogers, 1975) has also been widely applied to understand cancer screening behaviours. PMT proposes that health-related decision making is influenced by two cognitive appraisal processes i.e. threat appraisal (perceived severity and vulnerability) and coping appraisal (self-efficacy, response efficacy and response costs), which together shape an individual’s motivation to engage in protective behaviours such as cancer screening (Rogers, 1983).Thus, behaviour change models have been used to explain and understand cancer screening behaviours across different settings. With the Health Belief Model (HBM) being widely accepted as one of the important theoretical frameworks that aims to explain and predict individuals' health behaviour. Grounded in the concept that individuals' perceptions of their susceptibility to and severity of a health condition, as well as their knowledge and beliefs about the benefits and barriers of acting, influence their health-related decisions, it provides the perfect setting to understand how socio-cognitive factors impact bowel cancer screening uptake. This thesis uses this framework to empirically examine and identify barriers and facilitators to bowel cancer screening across different groups, to investigate bowel cancer screening behaviour and intention across groups and to identify predictors of bowel cancer screening across different groups.

Protection Motivation Theory and Predictors of Bowel Cancer Screening

Protection Motivation Theory (PMT) explains the impact of persuasive communication on behaviour, with an emphasis on cognitive mechanisms underpinning the rationale to follow or not to follow a recommended behaviour (Rogers, 1975). What makes this theory unique is that PMT was one of the first theories focusing on how cognitions explain the tendency of people to protect themselves and it explored these factors within the context of healthcare. PMT was developed to address gaps in earlier health behaviour frameworks by offering a more comprehensive account of the cognitive processes underlying health protection decisions, particularly the motivational mechanisms that drive individuals to engage in protective behaviours. PMT goes beyond simply stating that the perceptions of threat severity, vulnerability, response cost, response efficacy and self-efficacy drive behaviour change, but also explains how individual cognitive processes including threat appraisal and coping appraisal separately impact decision making and health behaviour (Rogers, 1975). Thus, this theory provides a more comprehensive understanding of protection and motivation behaviour, making it an effective means to understand people’s motivation to engage in protective health behaviours like participating bowel cancer screenings. In addition to this, PMT also provides insights into factors that predict individuals’ adaptive and maladaptive coping responses to perceived threats, such as health risks or environmental hazard (Orbell, Johnstone & Crombie, 1996).

Cognitive factors such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action have been found to impact people’s intention and behaviour towards bowel cancer screening tests (Wenshuang Wei et al., 2022). PMT emphasizes a cognitive appraisal process of threat and coping to explain how people make the decision to engage in certain protective healthcare behaviours like screening (Orbell et al., 2017). Cognitive processes like Threat Appraisal explains how an individual evaluates the perceived severity of a threat and one's vulnerability to it, while Coping Appraisal explains how an individual assesses the perceived effectiveness of the recommended behaviour in reducing the threat (response efficacy) and the perceived costs of engaging in that behaviour; Self-efficacy according to PMT reflects an individual's confidence in one's ability to perform the recommended behaviour thereby predicting one's ability to engage in said behaviour (Rogers, 1975). PMT suggests that individuals are more likely to engage in a protective behaviour if they perceive a high threat and believe that the recommended behaviour is effective and easy to implement. Sociodemographic factors such race, age and income have been found to predict bowel cancer screening behaviour; Psychological factors identified by health theories like PMT may explain variability in health behaviour that exist due to socioeconomic and cultural factors that go beyond just financial constraints that limit access to care, for example, social conditions that have been characterized by limited efficacy to overcome or prevent negative life experience may enhance the perceived costs of participating in screening or diminish self-efficacy to complete the test (Orbell et al., 2017). Thus, cognitive appraisals may vary as a function of SES factors (Orbell, Johnstone & Crombie, 1996; Whitaker, Good & Miles et al., 2011).

Thus, this framework helps to build the background against which one can examine and identify the different socio-cognitive predictors of engaging in protective behaviours like bowel cancer screening. To further explore how these socio-cognitive factors operate as predictors and to see how they impact protection motivation and bowel cancer screening intention, the quantitative study within this thesis assesses how predictors such as bowel cancer screening knowledge, fear, perceived susceptibility perceived severity, perceived benefits, perceived barriers, self-efficacy and SES factors like income, age and race impact bowel cancer screening intention across different populations.

Behaviour-Intention Link

Behavioural intention concerns a person's motivation to perform a behaviour (Sheeran, 2002). Intention determines the likelihood of an action being completed and is a strong indicator of whether an individual will participate in an action or not (Ajzen, 1991). Intention has also been seen as a strong predictor of health behaviours; this includes making health decisions like attending screenings (Sheeran & Orbell, 2000). Meta-analyses have placed the point estimate of the intention–

behaviour relationship as $r = .50$ (Armitage & Conner, 2001; Hagger, Chatzisarantis, & Biddle, 2002; Symons Downs & Hausenblas, 2005), which situates it within the large effect size range. With studies showing the importance of intention and establishing its impact on behaviour; it would therefore be useful to examine and identify factors that promote bowel cancer screening intention across different populations. This thesis aims to explore predictors of bowel cancer screening intention to understand how one can improve the uptake of bowel cancer screening programmes across different groups.

Cross-Cultural Comparisons

Bowel cancer screening rates have recently increased but remain low among people ages 50 and older. Those rates vary among people of different ethnic backgrounds, and understanding how cultural beliefs and other factors play into those disparities can help researchers develop better cancer screening programmes that are inclusive of people coming from different socioeconomic backgrounds and effective in boosting uptake across different populations. One of the fundamental issues with cancer screening studies is the lack of literature examining how cultural beliefs and socioeconomic factors impact uptake and diagnosis (Theisen, 2004). This lack of investigation often leads to disparities in cancer diagnosis and treatment outcomes. For instance, in a study it was found that Latin American (Latino) women in the USA were more likely to present with breast cancer at stages III and IV compared to their white counterparts, this is in addition to the fact that breast cancer screening rates are lower among Latino women compared to white women (Flynn et al., 2015).

Bowel cancer, screening rates vary across different ethnic groups. For instance, in Scotland, FIT uptake was found to be much lower in South Asian populations compared to White Scottish populations (Campbell et al., 2020). As previous literature has shown that bowel cancer screening behaviour and intention varies across groups, it would therefore be valuable to examine this variation and understand how different SES factors impact bowel cancer screening. Comparisons among different groups and across different cultures also allows one to gain insights into how socio-cognitive predictors of bowel cancer screening operate across different settings and identify what factors can help boost bowel cancer screening across different groups. This information would be useful in understanding how bowel cancer screening interventions can be made more effective to improve screening uptake across different populations. An important goal of this thesis is to ensure that the participants included within the different studies come from a diverse background. The empirical studies and the systematic reviews within this thesis are designed to examine bowel cancer screening intention and behaviour across different groups.

1.5 Thesis outline

Chapter 2

This chapter outlines the background for the present thesis by summarizing information regarding bowel cancer screening, screening uptake, factors impacting screening behaviours and intentions as well as walking the reader through certain inequalities observed within the area of bowel cancer screening. Additionally, this chapter explains bowel cancer screening uptake across groups and discusses existing bowel cancer interventions designed to boost uptake across groups. The chapter also provides the readers with an overview of the health inequalities observed within health research as a whole and concludes by providing a rationale for the various PhD studies included within the thesis by outlining the thesis aims.

Chapter 3

This study (Study 1) explored the barriers and facilitators experienced by people who are eligible for bowel cancer screening and are thinking about attending screening programmes. This study aims to understand what factors people consider important when they think about participating in bowel cancer screening tests. Qualitative semi-structured interviews were conducted with 30 participants, across three population groups and two countries. Reflexive Thematic Analysis was utilised to analyse the data using an inductive approach to coding. Themes revealed factors that facilitated people’s participation in bowel cancer screening while also identifying key factors that act as barriers against screening across different groups. Additionally, this study provides insights into what factors predict bowel cancer screening across different groups, these insights were later used to inform the empirical study that examined predictors of bowel cancer screening intention across different groups.

Chapter 4

This chapter presents a synthesis of the findings from the systematic review that investigates the predictors of bowel cancer screening across different groups. The review aims to identify key predictors of bowel cancer screening to help inform the following empirical study wherein the different predictors will be examined using a quantitative survey-based approach. This review helps readers understand how different predictors impact bowel cancer screening intention across different groups and what factors bowel cancer screening interventions need to address to boost screening uptake across different groups.

Chapter 5

In this study (Study 2) the predictors of bowel cancer screening are examined to investigate how they operate across different groups and to understand the relationship between predictors of bowel cancer screening and screening intention. Predictors identified within the systematic review and the qualitative investigation are examined in this survey-based study to provide insights into how these predictors impact screening intention across different groups. By analysing the relationship between predictors of bowel cancer screening and screening intention, this study helps identify the predictors that have a strong impact on screening intention across different groups which helps inform policy makers on what factors they need to focus on while designing bowel cancer screening initiatives to help boost screening intention across different groups.

Chapter 6

This chapter synthesizes the findings from the systematic review that examines the effectiveness of existing bowel cancer screening interventions across different groups. This review provides insights into what factors make bowel cancer screening intervention effective across different groups and how factors like ethnicity impact screening participation. This review helps inform policy makers on how existing bowel cancer screening interventions can be made more effective in terms of boosting participation across different groups and how they can be made more inclusive for people coming from diverse backgrounds.

Chapter 7

This chapter presents a discussion of the findings from the systematic reviews and empirical studies from this thesis within the context of understanding and identifying predictors of bowel cancer screening intention and behaviour across different groups and examining the effects of existing bowel cancer screening interventions to explore ways to make them even more effective and inclusive for people from varied backgrounds, along with the associated literature. The strengths and limitations of the thesis are considered and areas for future research are identified.

1.6 Chapter Conclusion

This chapter outlined the theoretical basis for the thesis and explained how the studies within this thesis align with the fundamental frameworks that exist within health psychology. This chapter also reviewed the key barriers and facilitators of bowel cancer screening and examined the social, cultural, and psychological factors influencing screening behaviours and intentions. Alongside this, the current chapter provides insights into the various studies within the thesis and highlights the rationale behind the thesis. The chapter concluded by examining the aims behind the subsequent studies and explaining how they come together in cohesion to create a meaningful thesis.

Chapter 2

Background, Overview and Thesis Context

2.1 Chapter summary

This chapter provides the background for the thesis and has five key aims. First, it introduces bowel cancer screening and summarises current screening programmes. Second, it examines screening uptake across different population groups. Third, it explores the psychological, social, and structural factors that influence bowel cancer screening behaviour. Fourth, it reviews existing interventions designed to improve screening uptake. Finally, it highlights inequalities in bowel cancer screening and situates these within the broader context of health inequalities research.

2.2 Brief overview on Bowel Cancer, Diagnosis and Treatment

Bowel Cancer is the third highest cause of cancer related deaths in the world (Lew et al., 2022). With approximately 16,800 deaths per year which translates to about 46 deaths per day. Globally, bowel cancer accounts for approximately 930,000 deaths annually (Sung et al., 2025). In the UK, bowel cancer is among the leading causes of cancer-related mortality, based on national cancer registry data (Office for National Statistics, 2024). Large geographical variations exist in the distribution of bowel cancer incidence and mortality, with higher rates observed in Western countries including the UK, Europe, Australia, and New Zealand; projections suggest that the global burden of bowel cancer will continue to rise by 2040 (Morgan et al., 2023). Within developing countries like India, bowel cancer incidences are on an upward trajectory. In 2022, India had the fifth highest number of bowel cancer deaths globally, with 38,367 deaths; India has the second-highest number of deaths due to bowel cancer in Asia due to late diagnosis and low screening rates (Shivshankar et al., 2025).

Most new cases of bowel cancer are seen among people with moderate risk of bowel cancer. 90% of new cases occur in individuals above the age of 50 and nearly 75% of these diagnoses occur among individuals without a family history or a genetic predisposition to bowel cancer, while approximately 20%-25% of people develop bowel cancer directly as a result from familial history or adenomatous polyps most of the people diagnosed would be considered as average-risk individuals (Haggar & Boushey, 2009; Valle, 2014). Although the cause of bowel cancer remains elusive, certain factors have found to associated with bowel cancer incidences. For instance, Patients with inflammatory bowel disease (IBD) have a higher risk of developing bowel cancer than the general population; the risk of bowel cancer was found to be a direct function of the length of time an individual has had IBD and the extent of intestinal involvement (Ryan et al., 2014). Genetics also plays a large role in increasing the risk of bowel cancer, twin studies placed bowel cancer as second among the common cancers in terms of heritability, with a genetic contribution of 35% (Albert de la Chapelle, 2004). Environmental and social factors like dietary constituents, particularly the proportions of animal protein and fat, have been shown to correlate well with the geographical variations in the incidence of bowel cancer (Berg et al., 1975). Lifestyle choices also impact the development of bowel cancer, within the UK at least 10% of colon cancers are obesity-related, with visceral, abdominal fat accumulation being highlighted as an important risk factor (Ning, Wang, & Giovannucci, 2010; Organization, 2007; Riondino et al., 2014).

With the factors leading to bowel cancer being so varied, factors found to be protective against bowel cancer are also varied in nature and combine environmental and social variables. A meta-analysis reported an approximately 10% reduced risk of colorectal adenoma (CRA) per 10g/day increase in fiber (Ben et al., 2014) as well as chronic use of non-steroidal, anti-inflammatory drugs 16 (NSAIDs, e.g., aspirin), which appear to reduce bowel cancer risk by preventing inflammation in anatomic subsites within the colorectum. Low-dose daily aspirin use is an effective prevention strategy among individuals with a first-degree relative with a history of bowel cancer (Friis et al., 2015; Ruder et al., 2011). However, no single gene or factor has been found to be linked with the development of bowel cancer, more research is needed on understanding factors that might prevent the development of the disease. The progression of the disease, however, is well documented. Depending on the severity of the cancer (i.e., size of cancerous growths, whether the cancer has invaded regional lymph nodes or metastasised), there are four key stages of development. These stages are: Dukes’ A, where the tumor(s) has invaded into the inner lining of the bowel but has not grown through the muscle layer of the bowel; Dukes’ B, where the tumor(s) has grown through the muscle layer of the bowel; Dukes’ C, where the tumor(s) has spread to at least one lymph node close to the bowel; and lastly, Dukes’ D, where the cancer has metastasised to other organs of the body (Akkoca et al., 2014).

Since bowel cancer is a progressive disorder the stage at which it is diagnosed is indicated by the symptoms experienced by the patients; the stage of diagnosis also determines the treatment and prognosis. Thus, degree symptoms like blood in stool, abdominal pain, and constipation is linked to the stage of cancer.
Patients who are diagnosed with bowel cancer after having experienced symptoms over a long period of time are usually considered to have advanced cancer tumors compared to asymptomatic patients. Patients who are symptomatic and who have experienced multiple symptoms like blood in stool combined with abdominal pain seem to have poorer health prognosis compared to those who are asymptomatic; Moreover, asymptomatic patients who have been diagnosed early have greater chance of undergoing minimally invasive surgery (e.g., polypectomy) compared to patients with advanced bowel cancer , which require more invasive treatment procedures, including surgery/laparoscopic colectomy which is required to treat the majority of patients presenting with later stages and is usually combined with chemotherapy (Goiffon et al., 2021, Miller et al., 2016). Thus, bowel cancer prognosis is better when the patients are diagnosed early.

Additionally, bowel cancer diagnosis carries physical and psychological costs for the patient and their family. Even after all the accommodations made by workplaces and taking into account sick pay most families reported facing financial restraints and reduced quality of life, combine this with the changes needed to be made to accommodate the reduction in mobility due to bowel cancer treatment and other changes required to be made to the living space and various lifestyle adjustments required for good prognosis, bowel cancer diagnosis comes with a significant economic burden (Ó Céilleachair et al., 2012). With bowel cancer screening rates being lower among low socioeconomic groups leading for late diagnosis and more aggressive treatments these costs can be even more economically devastating and emotionally troubling (Palmer et al, 2014). Alongside the economic effects of bowel cancer diagnosis, the negative impact on patients' general wellbeing and mental health should also be noted; with a large proportion of patients diagnosed with advanced bowel cancer reporting higher levels of symptoms of depression and anxiety, reduced cognitive, emotional and social functioning over time and overall lower ratings of both global and health-related quality of life (HRQOL) that last many years post-diagnosis (Denlinger & Barsevick, 2009; Frazzetto et al., 2012;

Mols, Schoormans, de Hingh, Oerlemans, & Husson, 2018; Ramsey, Berry, Moinpour, Giedzinska, & Andersen, 2002; Siegel et al., 2017).

Along with being a significant economic burden on the patient, bowel cancer is also a burden on healthcare organizations across the globe. Bowel cancer places a substantial economic burden on the NHS and the wider UK economy. Direct costs to the NHS, including diagnosis, treatment, and palliative care, are estimated at £1.1 billion annually which is only estimated to go up (Mukherjee et al., 2016). A US study included both direct costs of medical care and indirect costs such as time spent by the patient travelling to hospital, waiting for care, and receiving care; the study estimated that the total direct and indirect cost of bowel cancer was $7.49 billion (£4.94 billion) in 2000 with projections of an increase to $11.43 billion (£5.78 billion) by 2020 (Bending et al., 2010). In developing countries like India, non-medical costs on food, transportation and lodging by the patients (since cancer treatment facilities have a poor geographical dispersion), and time spent by caregivers, and productivity and earning loss due to cancer-related disability exacerbate the cost of cancer care, making it an even bigger burden on both the patient and the nation (Goyanka et al., 2023). With the changing economy and cost of living crisis looming on nations worldwide, projections of the costs of future bowel cancer care and treatment suggest that the economic burden of cancer is expected to increase significantly, with these increases being primarily attributed to an aging and growing population, and increases in the costs of medical care (Lang et al., 2009). Thus, various study findings strongly indicate that bowel is a significant public health issue and there is a need for better more effective public health initiatives that promote early diagnosis and routine screening to help reduce mortality and treatment costs.

2.3 Bowel Cancer Screening and Early Diagnosis

Screening for bowel cancer and early detection is found to be an effective way of reducing mortality (Thomas, 2021). Since Bowel Cancer is a progressive disease and the cancer itself is slow growing, arising from precursor lesions such as adenomatous polyps or sessile serrated lesions; this slow progression enables a window of time to screen for both early cancer and precursor lesions, allowing for easier treatment and better prognosis (Shaukat et al., 2022). Screening therefore has a central role in bowel cancer prevention and treatment. The purpose of screening is to reduce bowel cancer incidence and mortality by increasing the chances of detection at an early stage when the cancer is highly treatable and requires less invasive treatments thereby reducing the negative impact on the patient as well as improving the chances of survival. With the help of early detection, the survival rate can go up to 90% (Crosby, D et al., 2022). Early detection of bowel cancer is possible by attending the various bowel cancer screening programmes that are made available by the government agencies across the globe, for free in most developed and developing countries like the UK, India, France, Germany and so on (Office for National Statistics, 2024).

Bowel Cancer prognosis has slowly been improving across the globe, however due to the elusive nature of the disease and the inability to identify factors that are protective against it, early diagnosis is crucial. Both advanced age and stage at diagnosis limit the opportunity for curative treatment; diagnosis at earlier stages in disease development leads to a dramatic change in prognosis, thus, screening is presently the key intervention (Stracci et al., 2014). In a meta-analysis of 10 RCTs and 47 studies looking into the pooled bowel cancer-specific mortality rate ratios across different screening modalities, found that biennial FIT/gFOBT, single and 5-yearly FS, and 10-yearly colonoscopy screening significantly reduced bowel cancer-specific mortality: the effectiveness of screening increases at younger screening initiation ages and higher adherences (Zheng et al., 2023). More specifically, the effectiveness of the FIT test was found to be associated with a lower risk of death from bowel cancer, with some studies reporting a 33% reduction in risk (Douben et al., 2017). A meta-analysis from 3 RCTs also found that bowel cancer mortality was reduced by 16% in populations offered gFOBt screening compared with populations not offered screening, with one year survival for those diagnosed with stage 1 (earliest) cancer being 98% for men and women whereas when detected at stage 4 (the most advanced stage), 1 year survival is much lower, up to 44% for men and 35% for women (Logan, R. F et al., 2012).

Large scale RCTs examining the effectiveness of flexible sigmoidoscopy were initiated in the late 1990’s, with publication of long term (10 years or more) results in 2010 (UK Flexiscope Trial), 2011 (Italy’s SCORE trial), 2012 (the US Prostate, Lung, Colorectal, and Ovarian Cancer trial), and 2014 (Norway’s NORCAPP); with all demonstrating a reduction in bowel cancer incidence in the distal colon (the region within the reach of the flexible sigmoidoscope), mortality was also significantly reduced for 3 of the 4 trials, with further reductions expected with continued follow-up; the largest incidence effect was achieved in the UK flexiscope trial with 23% reduction in mortality for intent to treat and 33% reduction for per protocol analysis, with the reduction primarily due to a 50% reduction in the distal colon (Zauber, 2016). Thus, various study data indicates that bowel cancer is largely treatable when diagnosed at the earliest stage possible and that earlier diagnosis of cancer through screening should be a key priority for achieving the best cancer outcomes.

Additionally, a range of behavioural models have been applied to understand participation in cancer screenings and early diagnosis. Stage-based models, such as the Transtheoretical Model (TTM), conceptualise behaviour change as a progression through discrete stages of readiness, from precontemplation to maintenance, and have been used to identify individuals’ preparedness to engage in screening. Similarly, the Precaution Adoption Process Model (PAPM) focuses on the sequence of cognitive stages individuals move through when adopting health-protective behaviours, particularly distinguishing between lack of awareness, decision-making, and action. More recently, models such as the Integrated Screening Action Model (i-SAM) have been proposed to synthesise elements of intention formation, decision-making, and action within screening contexts. While these models provide valuable insights into screening decision processes, they primarily emphasise stage progression or behavioural adoption rather than the cognitive mechanisms underpinning motivation. The present thesis therefore focuses on Protection Motivation Theory (PMT), as it explicitly distinguishes between threat appraisal and coping appraisal processes and provides a theoretically robust framework for identifying modifiable psychosocial predictors. PMT is particularly well suited to bowel cancer screening, where perceptions of risk, fear, efficacy, and response costs play a central role in decision-making, and where theoretically derived predictors can be directly mapped onto intervention strategies aimed at improving screening uptake across diverse populations.

Given the importance of bowel cancer screening and early diagnosis it becomes important to familiarise oneself with the various bowel cancer screening modalities and screening programmes currently being utilised globally.

2.3.1 Bowel Cancer Screening Tests

Non-Invasive Screening Tests

The Guaiac Faecal Occult Blood Test (gFOBT) and the fecal immunochemical test (FIT)

The guaiac FOBT test (gFOBT) has been used over the years as a screening test for bowel cancer across different countries. The test has exhibited a sensitivity of 12.9%-79.4% with a specificity of 86.7%-97.7% for bowel cancer screening in many studies (Le-Le Song et al., 2016). This test is used as a screening tool, it operates by observing small, macroscopically invisible traces of blood (occult blood) that are released into the bowel lumen when bowel cancer is present; The gFOBT therefore analyses stool samples for the presence of this occult blood and gives a diagnosis. This test has been a norm within western countries across Europe due to its effect on bowel cancer mortality which has been validated in randomized trials, it's simple to perform nature, non-invasiveness and cheap price of production (Bretthauer, 2011). However, the sensitivity and specificity of this test for bowel cancer detection is lower than the more specific tests that are also non-invasive and easy to use like the FIT (previous called iFOBT) test. The gFOBT relies on peroxidase-like activity between heme and guaiac, which can be affected by many factors in daily diet without distinguishment between upper and lower gastrointestinal (GI) tract bleeding, thus making it less sensitive; while the FIT test for instance targets the hemoglobin in the lower GI tract, as hemoglobin from upper GI tract will be degraded when it arrives at lower GI tract, this allows FIT test to specifically detect the bleeding and therefore detect the diseases with bleeding, such as adenoma, polyps, inflammatory diseases and bowel cancer etc. (Le-Le Song et al., 2016).

The FIT test being the more sensitive test and overcoming the drawbacks of gFOBT has quickly become the main test for bowel cancer screening. For instance, The National Screening Service (NSS) began a nationwide bowel cancer screening programme (BowelScreen) in 2013 using the fecal immunochemical test (FIT) as the FIT quantitatively measures only human blood and is easier to use than the gFOBT (O'Donoghue, 2019). Since July 2017 the faecal immunochemical test (FIT) has been recommended by the National Institute for Health and Care Excellence (NICE) as well. The NHS has also reverted to using FIT test as its primary mode of screening, the NHS England Bowel Cancer Screening Programme (BCSP) currently uses a threshold of 120 µg Hb/g feces for the test (Cancer Research UK, 2025). FIT test has been proven to be an asset when it comes to bowel cancer screening with a study showing that in over 9896 adult patients with at least 6-month follow-up, a FIT result ≥10 µg Hb/g feces had a sensitivity for bowel cancer of 90.5% (95% *CI* [84.9%-96.1%]), specificity 91.3% (90.8%-91.9%), positive predictive value (PPV) 10.1% (8.15%-12.0%) and negative predictive value (NPV) 99.9% (99.8%-100.0%) (Nicholson et al., 2020).

Invasive Endoscopic Screening Tests

Screening Colonoscopy (SC) and Flexible Sigmoidoscopy (FS)

Colonoscopy is often suggested as the preferred screening test as it detects both types of cancers (Colon and Rectal) as well as precancerous lesions with high reliability. Thus, examination of the entire colon using a flexible colonoscope is the “gold standard” investigation for bowel cancer. Colonoscopy allows for direct assessment of the entire colonic mucosa as well as removing adenomas. In a large-scale study that analysed over 1747 patients who died from colorectal cancer and 3460 colorectal cancer-free controls, it was found that compared with no endoscopic screening, receipt of a screening colonoscopy was associated with a 67% reduction in the risk of death from any colorectal cancer, by cancer location, screening colonoscopy was associated with a 65% reduction in risk of death for right-colon cancers and a 75% reduction for left-colon/rectal cancers (Doubeni et al., 2016).

In most countries however colonoscopy is used as the second step in the screening process after the faecal occult blood testing (with gFOBt or FIT); this is because of cost and resource constraints. For instance, within the UK colonoscopy is only offered as a follow-up test for those with a positive result on a home screening kit (FIT) and is generally used for individuals at higher risk of bowel cancer, such as those with genetic conditions, inflammatory bowel disease, or strong family history (NHS England, 2025). In some developing countries however colonoscopy is the only form of screening available to their citizens; in countries like India and China, where population is a lot more spread out and services are already overwhelmed, home kit tests like the FIT have not been made available due to logistical restraints (Indian Cancer Society, 2024). Colonoscopy however does come with its own drawbacks. Colonoscopy can lead to potential complications including bleeding, bowel perforation, complications of sedation, and complications of bowel cleansing preparations. Within the UK, overall low rates of serious complications have been reported by the English BCSP. However, it is important to note that colonoscopy can be an uncomfortable procedure, and overall patient experience should be maintained at an acceptable level to ensure it is a viable screening option (Bevan et al., 2018).

FS on the other hand only inspects the left side of the colon for neoplasia which is why it is usually used in conjunction with colonoscopy where a colonoscopy is suggested after a positive FS result. It is considered more user friendly and cost effective compared to a colonoscopy and has proven its effectiveness over the years. FS screening was associated with at least a 30% reduction in bowel cancer related mortality in case-control studies (Levin et al., 2002). However, it does have its drawbacks including potential gastrointestinal complications from chemicals used for endoscope sterilization, bowel perforation, bleeding, and infection; acute diverticulitis may also be related to FS because it is a microscopic perforation of the colon, and perforation may be induced by mechanical or pneumatic trauma during the test (Levin et al., 2002; Yang et al. ,2018).

Due to the invasive nature of these tests and potential for complications having non-invasive tests in place has become the norm in most developed countries and this also allows for better patient experience and makes screening more accessible.

2.4 Importance of Screening and Early Diagnosis

Bowel cancer is an important health burden and the most frequently occurring cancer worldwide in both sexes combined; screening for bowel cancer is the most ideal path for bowel cancer control as in the majority of cases, the disease develops over many years and detection followed by removal of pre-malignant lesions can prevent progression to cancer and decrease risk of mortality (Beck, 2015; Stracci et al., 2014). Thus, the purpose of the screening tests is detecting bowel cancer at early stages when the disease is highly curable. Implementing screening protocols has led to a reduction in cancer incidence range from 39% to 60%, and reduction in mortality from 55% to 80%, compared to no screening (Lopes et al., 2024). Bowel cancer screening also has considerable economic implications. By enabling early detection, it helps reduce the impact of the disease on the patient, their families as well as the healthcare system. This is achieved in two ways, 1) By detecting cancer early the treatment that follows is less invasive and has more favourable prognosis, 2) Early diagnosis also reduces the overall cost of the treatment thereby reducing the burden on the patient as well as the society. For those already diagnosed, screening can also serve as a vital tool for monitoring disease progression and assessing the efficacy of ongoing treatment, enabling clinicians to make timely adjustments to therapeutic strategies (Li et al., 2024).

Thus, having access to screening and early diagnosis helps reduce the incidence of bowel cancer and improves mortality rates. Within the UK alone, the introduction of the English Bowel Cancer Screening Programme (BCSP) in 2006 has led to decrease in the incidence of bowel cancer in the lowest portion of the large bowel by almost 7%; with the introduction of FIT tests in 2019 and the plan to reduce screening age limit to 50 by the end of 2025, the reduction in incidence of bowel cancer and mortality rates is projected to be even more significant (Granger, S. P et al., 2023). Screening for bowel cancer has therefore proven to be an important part of healthcare and therefore access to it should also be considered as a healthcare priority. However, the uptake of bowel cancer screening tests remains low (Cancer

Research UK, 2025). There are also large disparities that have been observed in the uptake of these screening tests and within certain minority groups these screening tests are still not the norm.

2.5 Inequalities in Health and Health Research

Sociocultural factors like norms, attitudes, sex and ethnicity have been found to affect health cognitions. These factors moderate behaviour, attitudes and health decisions. A person's sociocultural background not only impacts the individual's willingness to participate in health behaviours but also impacts the way they interpret health information (Naderbagi et al., 2024). Additionally, it was found that certain kinds of behavioural interventions might not even be effective on all population groups due to the impact of their individual socioeconomic backgrounds and cultural values; hence it is important to curate health interventions with the specific target population in mind to obtain favourable health outcomes (Conner et al., 2021). Cultural values that a person carries with himself also determines if that person will adhere to a treatment programme. Values like not being open to communicate intimate thoughts and feelings (something that is common in Asian culture), if not addressed properly can hamper treatment outcomes. Ignoring a person's cultural background can lead to misdiagnosis thereby affecting well-being of the minority communities (Leong & Lau, 2001). The link between SES and health has been well established within health research as multiple studies have found that SES factors like income, ethnicity and gender have a direct link with health outcomes. In a study looking at a total of 697,981 colorectal cancer cases over a 5-year study period, found that there was an 11% higher risk of both colorectal cancer incidence and mortality for people living in low-income households (Althans et al., 2024). With the Healthy People 2030 goal being “create social, physical, and economic environments that promote attaining the full potential for health and well-being for all”, researchers are now understanding the impact of SES factors on health and well-being (WHO, 2025).

However, just because there is an increase in the number of studies looking into the impact of SES on health, does not mean that health disparities do not exist within the healthcare system and health research. Even today, in many western countries' minority groups have worse health outcomes compared to the majority groups across the board. In the United States (U.S.) for example, racial and ethnic minorities fare significantly worse than their white counterparts on nearly all health outcomes, including cancer, cardiometabolic disease, infant mortality, and mental health (Sonderlund et al., 2022). Within the UK, Asian and Black ethnic groups have poorer outcomes for cancers and are less likely to report a positive care experience than their White counterparts (Martins et al., 2022). The lifetime risk of being diagnosed with prostate cancer is two-to-three times higher among Black British men than among white British men and Black British men are twice as likely to die of prostate cancer as white British men; these racial inequalities are not only limited to health outcomes and diagnosis but also impact access to healthcare, screening and treatment across developed countries like the UK, US and across Europe (Dee et al., 2025). Within the UK research has also shown that people living in less deprived areas experience lower mortality and longer life expectancy than those in more deprived areas and such inequalities are also found for cause-specific health outcomes for various diseases, including many types of cancer (Ingleby et al., 2022).

To understand how these health disparities came into existence and how they have persisted within the healthcare system for decades it is important to understand what health disparities actually mean; disparities and inequalities within healthcare are defined as systematic differences in the use or receipt of health care services between white and non-white individuals, men and women, the insured and the uninsured, people with and without disabilities, rural dwellers and urban dwellers, or people with high versus low education, who have comparable need for such services (Williams et al., 2005). Many systemic factors contribute towards health disparities like health system characteristics such as the availability of health care resources, the manner in which health care providers are compensated, and the training and practice styles of clinicians that may vary across sites or over time, personal factors such as age, gender, race/ethnicity, marital status, education, occupation, attitudes and beliefs, income, health insurance coverage, language proficiency, and patient perceptions of need as well as environmental factors like the availability of community resources such as housing, transportation, and social support (Begley et al., 2011). According to the socio-behavioural framework of health care, race/ethnicity and socioeconomic disparities in health care are measured by examining the association between these factors in explaining who gets care and the outcomes of care while controlling for need, health system, and environmental factors. This phenomenon is explained through a longitudinal study examining socioeconomic health inequalities over a period of 10 years, which found that the proportion of participants reporting worse health-related outcomes was most significant among those with greater socioeconomic hurdles (Elstad & Krokstad, 2003).

Heath outcomes also vary both across and within countries. For instance, within India Indigenous people living in more rural areas are amongst the poorest and most marginalized population groups experiencing extreme levels of health deprivation compared to people living in more urban cities (Subramanian et al., 2006). With the UK, like in most countries, there is a persistent gradient in mortality and morbidity or illness according to the levels of socioeconomic positions (Tanaka et al., 2011). It is therefore clear that the impact of these socioeconomic factors on health varies between and within countries. The nature of the impact of these factors is dynamic rather than static which means that several factors like change in the economy, resources, age of the population and so on interact with psychosocial factors to determine the health outcomes of the people at a particular time point. The fact that the social gradient of health is not fixed means that there is not a set standard for measuring socioeconomic inequality in healthcare which in turn suggests that population’s health can fluctuate in response to a range of structural determinants, including age, income, education, occupation, gender, race, ethnicity and place of residence (Tsipa, 2018, pp. 22–23). The dynamic nature of this problem also opens an opportunity for a solution in the form of development of interventions and policies that are also dynamic in nature and target the specific problems faced by the population at that time to reduce inequalities in health. Thereby, underlining the importance of having interventions that understand the needs of the specific target group rather than a standard one that is applied throughout the country.

In the recent years, significant amounts of resources have been dedicated towards understanding the impact of SES factors on health and making health research more diverse in terms of including participants from all different walks of life, ethnicities and ages. However, the analysis of these factors in health research is almost always dependent on data availability and any discussion of the specific way SES might have exerted its influence within this context is usually limited to observations and is rarely ever made the focus (Shavers, 2011). Additionally, study findings over time illustrate the role of biomedical and neoliberal discourses in promoting a narrow conceptualisation of health, and a focus on individual responsibility and behaviour (Babbel et al., 2017; Brassolotto et al., 2014); even when practitioners discuss the role of social conditions, this rarely leads to consideration of the political processes which shape them (Mackenzie et al., 2017; McIntyre et al., 2013). Thereby, adopting a narrow view on health inequalities and the role health organizations could play to mitigate them. With respect to ethnicity, inclusivity in health research has always been a point of contention. Mainstream health research is usually focused on the health outcomes of the majority population groups and minority groups are usually not represented adequately in health research. Factors such as difficulty in recruiting participants from specific groups, lack of resources, lack of language skills and time restraints are usually quoted as reasons behind inequalities in ethnic representation in health research. In a systematic review examining studies on prostate cancer that compared oncologic outcomes between Black men and White men from January 1960 to June 2020, found that out of the 249 studies examined only 4.0% ($n = 10$) acknowledged or interpreted race as a social construct, and 0.8% ($n = 2$) made any acknowledgment of racism. Although there is an increasing trend in the number of published articles examining racial disparities in prostate cancer over time ($R2 = 0.68$), there is weak to no correlation in the improvement of describing race as a social construct ($R2 = 0.16$) or the acknowledgment of racism over time ($R2 = 0.01$) (Vince Jr et al., 2021).

Ethnicity also determines other SES factors like income for example, which then in turn impacts overall health outcomes. For instance, an examination of the levels of overall poverty by race from 1980 to 2006 showed that Black and Hispanic ethnic groups had two to three times higher overall poverty compared to White ethnic groups (DeNavas-Walt, 2010). Most research studies show that persons classified as “low income” typically die at the highest rates for most major causes of death and they experience more ill health and disability (Turrell, 1999). It is therefore imperative that all groups are adequately represented within health research to allow for the development of interventions and policies that are effective across groups; unfortunately, this is not always the case. Randomized controlled trials (RCTs) came to be regarded as the gold standard in evidence-based medicine to determine the safety and efficacy of medical therapies; the results from these RCTs are largely considered to be generalizable to all patient populations (Bothwell et al., 2016), over time however, growing evidence has surfaced to challenge that assumption (Sirugo et al., 2019). Research has demonstrated that many groups are underrepresented and excluded in clinical research which can affect how they will respond to a drug or therapy (Beglinger, 2008; Crawley et al., 2003; Garcia et al., 2016; Ramamoorthy et al., 2015). These differences in representation have also been noted in the case of male vs female participant representation. For instance, men are more likely to respond to tricyclic antidepressants and women to selective serotonin reuptake inhibitors as treatment for depression however to understand these differences in drug effectiveness, clinical trials need equal representation to examine how these drugs impact the different genders (Baca et al., 2004; Bano et al., 2004; Kornstein et al., 2000). Within the UK data suggests that socioeconomic inequalities are fundamental cause of ethnic inequalities in health and there are direct associations between ethnic minority status and ill health on the one hand and socioeconomic disadvantage on the other (Bartley, Sacker, & Clarke, 2004; Emerson & Hatton, 2007). Given the importance of these factors on health and health outcomes, it is imperative that all groups are adequately represented in health research.

2.6 Inequalities in Bowel Cancer Screening Intention and Behaviour

Inequalities exist in cancer diagnosis and disease outcome. In countries where medical organisations are funded by the public with the aim to mitigate financial barriers to healthcare like in the case of UK, health disparities still exist when it comes to cancer outcomes; racial disparities in outcomes in the UK point to the complexity underlying these disparate outcomes that extend beyond direct financial factors in health-care access and health literacy, factors like family history explain some of these disparities but understanding environmental, systemic and behavioural factors might help identify ways to promote equity (Jones et al., 2014). Disparities in screening have the potential to influence observed differences in diagnosis and mortality, the high incidence of prostate cancer for example in high-income settings such as the UK and the USA is testament to the uptake of screening compared with low- and middle-income country settings (Hassanipour-Azgomi et al., 2016). In line with other cancers, bowel cancer outcomes and incidences vary across groups, the public health burden of bowel cancer varies both by level of SES (Faggiano, Partanen, Kogevinas, & Boffetta, 1997) and by ethnicity (Espey et al., 2007; Trivers, Shaw, Sabatino, Shapiro, & Coates, 2008; Wong, Ettner, Boscardin, & Shapiro, 2009). Socioeconomic depravation and belonging to minority groups have been seen to influence bowel cancer screening uptake, disease outcome and mortality rates across different countries. For example, Black and South Asian adults, living in the UK, are less likely to be diagnosed via screening which is the diagnostic route associated with the best outcomes for bowel cancer, compared to their white counterparts (Martins T et al., 2022). A total of 155,038 individuals were screened across West London. Screening compliance was highest among White British individuals (52.6%), followed by Asian Chinese (50.8%) and White Irish groups (50.9%). Compliance was lower among South Asian and Black groups, including Indian (41.0%), Black African (40.1%), Pakistani (33.2%), and was lowest among Bangladeshi individuals (29.4%). Individuals with no ethnicity recorded had a compliance rate of 37.5% (Singh et al., 2021).There is strong evidence for socio-economic differences in cancer survival rates, with lower survival rates among adults living in the most deprived areas compared to those living in the least deprived areas being consistently reported within England and Wales across many cancer types (Coleman et al., 2004; Woods et al., 2006).

There are several factors that might lead to disparities in bowel cancer outcomes and treatment adherence; real life factors like access to healthcare, health literacy, resources etc coupled with personal and environmental factors like diet, housing, lifestyle, cultural values, attitude towards preventive healthcare and so on affect people’s participation in bowel cancer screening initiatives and treatment outcomes. For example, Sloggett et al. (2007) found that socioeconomic differentials in survival from bowel cancer varied by indicator used, whereby household access to a car and housing tenure were significantly associated with bowel cancer survival. Thus, highlighting the association between poorer survival rates with lower socio-economic status. Systematic factors like less access to curative treatment, greater risk of receiving poorer quality care, poor dietary habits and less access to fresh produce, higher obesity rates, lower physical activity, greater tobacco and alcohol consumption and greater medical mistrust also contribute towards poorer bowel cancer outcomes (National Cancer Intelligence Network, 2014). The biggest barrier to better treatment outcomes when it comes to bowel cancer is disparities observed when it comes to screening uptake which in turn influences mortality rates; bowel cancer screening rates are disproportionately lower among people coming from deprived areas and for minority groups (Tsipa et al., 2021). The percentage of gFOBt uptake for instance, varies considerably across different groups, with the uptake being almost 61% among the least deprived areas and the uptake declining considerably to 35% among the most deprived areas (Palmer et al., 2014). These patterns are also prominent among members of ethnic minority groups, who are not always the focus of mainstream health research and hence their cause for non-participation remains elusive (Robb et al., 2008). Low participation rates among people belonging to lower SES groups and people who come from ethnic minority groups is also observed in developing countries like India, wherein the uptake of bowel cancer screening is considerably higher among people who are educated and live in more affluent areas compared to those who live in rural areas and might not be as educated (Patil et al., 2017).

Disparities in screening go beyond just the socioeconomic factors; psychological and cultural factors impact screening uptake across different groups; factors within an individual’s environment also determines their intention to participate in bowel cancer screening. For example, when a person has better access to healthcare, they might be more receptive to screening initiatives; an interesting phenomenon being observed is where Indians living in the UK show better preventive health behaviours like participating in cancer screening than Indians living in India because of easier access to healthcare facilities in the form of NHS compared to the services in India which are harder to access(Singh et al., 2002). Although, SES factors undoubtedly influence screening uptake (e.g., income, education, employment) one cannot deny the role of psychosocial factors that can act as barriers against screening among more deprived populations. For instance, multiple studies have demonstrated how limited health literacy and limited access to health information can impact screening uptake especially among ethnic minority groups who might not always have access to the right healthcare information in the way majority group members do, and some might even struggle to understand the language used in the health information leaflet (Curry et al., 2003; Pelullo et al., 2022; White et al., 2019). In a meta-analysis significant association was found between adequate health literacy and higher screening participation for breast, cervical and bowel cancer screenings (Baccolini et al., 2021). Apart from this, psychological factors like self-efficacy, attitude towards screening and medicine, fear and perceived vulnerability as well as emotional and practical barriers towards screening maintain the low screening rates across groups; in a study it was found that across China, factors like perceived severity, benefits of bowel cancer surveillance and barriers to surveillance impacted the people's decision to undertake bowel cancer screening (Bai et al., 2020). Efforts are now being made to understand how these psychological factors combine with SES factors to impact bowel cancer screening and how this phenomenon can be explained using theoretical frameworks to better understand and identify ways to remedy this problem. For instance, the Health Belief Model, which is a widely accepted theoretical framework that aims to explain and predict individuals' health behaviours and explains how individual's perceptions of their susceptibility to and severity of a health condition, as well as their knowledge and beliefs about the benefits and barriers of taking action, influence their health-related decisions, is one of the front runners for explaining the disparities in bowel cancer screening uptake across groups (Estebsari et al., 2025).

In a review of 94 qualitative studies, specific barriers within low uptake groups included language barriers, logistical issues with attending screening tests, and cultural beliefs (Honein-AbouHaidar et al., 2016); thereby highlighting the importance of addressing these barriers to boost uptake. Gender and economic factors also impact screening intention and decisions; in a review by Mosquera et al. (2020) it was found that in over 96 studies, mainly conducted in the UK (*n*=29) and US (*n*=18), being male and higher levels of deprivation was found to be associated with lower participation in bowel cancer screening. In a larger scale study, Wagner and colleagues (2009) examined the gFOBT uptake rates over the first 30 months of the National Screening Programme in London with a sample of over 400,000 participants; it was found that a strong socioeconomic gradient exists in gFOBT uptake (49% and 32% uptake in the least and most deprived quintile of postcodes respectively). Von Wagner et al (2011) later conducted a follow-up analysis to include UK-wide data analysed data from 2.6 million participants that were invited to take part in gFOBT screening between October 2006 and January 2009, a similar pattern of findings was observed, where a clear socioeconomic impact in uptake was highlighted again. A cross- cultural UK-based study (Szczepura, Price, & Gumber,

2008) analysed gFOBT uptake patterns among a sample of 123,367 participants to compare uptake rates between South Asian and non-Asian UK populations, as well as between five Asian subgroups (including Hindu-Gujarati, Hindu-Other, Muslim, Sikh and South Asian Other) to understand how psychosocial factors impact screening intention and decisions; the study found that uptake rates were significantly lower among South Asian populations compared to non-Asian populations (32.8% and 61.3% uptake respectively) and that rates were particularly low for the Muslim subgroup.

Although, increased FIT uptake and FIT sensitivity have led to more people in England being invited for further follow-up tests, in most cases this being a positive FIT follow-up colonoscopy examination (Moss et al., 2017). Bowel cancer outcomes and mortality rates still display disparities across groups. In a study looking at 5016 patients diagnosed with bowel cancer aged 50+ living in the UK, found that probability of death from all-causes was lower among those with a degree, compared to no degree and higher among those employed in manual occupations, compared to non-manual occupations and among those living in social-rented housing, compared to owner-occupiers; in terms of individual indicators of SES, those living in the most deprived areas had a higher probability of death compared to those in the least deprived areas (Sturley et al., 2023). In a study by Siegel and colleagues (2017) which analysed the US-based data on bowel cancer incidence, survival, mortality rates and trends by gender, age group, anatomic subsite, race/ethnicity and geographic area; results indicated that incidence rates in non-Hispanic Black populations were approximately 20% higher than the rates of non-Hispanic White populations, and the magnitude of the disparity for mortality was double that for incidence, the authors also reported that differences in screening uptake were estimated to account for 40% of the racial disparity in bowel cancer mortality between Black and White ethnic groups.

In a study examining the uptake rate of the 4,423,734 gFOBT kits sent out to men and women aged 60-64 years for the first-time, between 2010 and 2015 within UK, found that only 51.68% were returned; with uptake among women (56.08%) being higher than that among men (47.30%), uptake ranged from 43.03% in the most deprived quintile to 56.96% in the least deprived quintile, uptake also varied by area-level ethnic diversity from 40.53% in the most ethnically diverse quintile of areas to

56.31 in the least diverse quintile of areas (Hirst et al., 2018). It is well documented that bowel cancer screening and early diagnosis is the most effective way of improving health outcomes and reducing the overall burden placed on the healthcare system by this disease (Wardle et al., 2016). These studies therefore evidence the need for reductions in screening disparities which could in turn lead to substantially fewer disparities observed at stage of diagnosis, which consequently would also reduce disparities in mortality and would lead to better health outcomes across the board. Research also shows the need for improving screening uptake across groups in order to help tackle the burden that is bowel cancer and to reduce mortality; by finding ways to make current bowel cancer screening initiatives more effective across groups better health outcomes can be guaranteed overall.

2.7 Existing bowel cancer screening initiatives and interventions

The UK like many other developed countries, has implemented a population based, national bowel cancer screening programme, which aims to identify early signs of cancer in people who are not currently experiencing any cancer symptoms to aid early diagnosis and non-invasive treatment. Within the UK, the National Health Service (NHS) runs the Bowel Cancer Screening Programme (NHSBCSP) which was officially introduced in 2006. Prior to the introduction of the programme, CRC screening had operated on an ad-hoc basis. According to a review by NHS England, the BCSP saves almost 9000 lives each year, through early diagnosis and prevention of bowel cancer (NHS England, 2019). By 2009, screening was made available to all men and women between the age of 60 – 69, the screening age was then further extended to up to 74-year-olds in 2014 (Bowel Cancer Research UK, 2024). Following the discontinuation of bowel scope screening in 2020, the screening age in England has been in the process of change, since 2021 being further extended to 50 to 74-year-olds which is aimed to be rolled out by the end of 2025 (NHS UK, 2025). The current BCSP in England consists of five hubs: the NE Hub - Newcastle, the Eastern Hub - Nottingham, the London Hub, the Southern Hub - Guildford, and the Midlands and the Northwest Hub - Rugby. These hubs issue out and analyse the test kits and provide support to the members of the public. Since 2019 in England and Wales, the gFOBt was replaced in the NHS with the faecal immunochemical test (FIT, as seen in figure 2.1 displayed below) (National Institute for Health and Care Excellence; NICE, 2019). The test is easier for people to complete as it is a home based, it only requires one sample and is mailed directly to the person’s house. People with a positive FIT result are invited, as part of the BCSP to a positive FIT follow-up colonoscopy examination. Within developing countries like India and China, the FIT test as whole is not the norm. Bowel Cancer screening operates a bit differently across countries. In India for example, Colonoscopy is the only way to screen for bowel cancer. The Indian Cancer Society runs free bowel cancer screening across the country, where people eligible for bowel cancer screening can come to the public hospitals within their county to get a free colonoscopy (India Cancer Society, 2025).

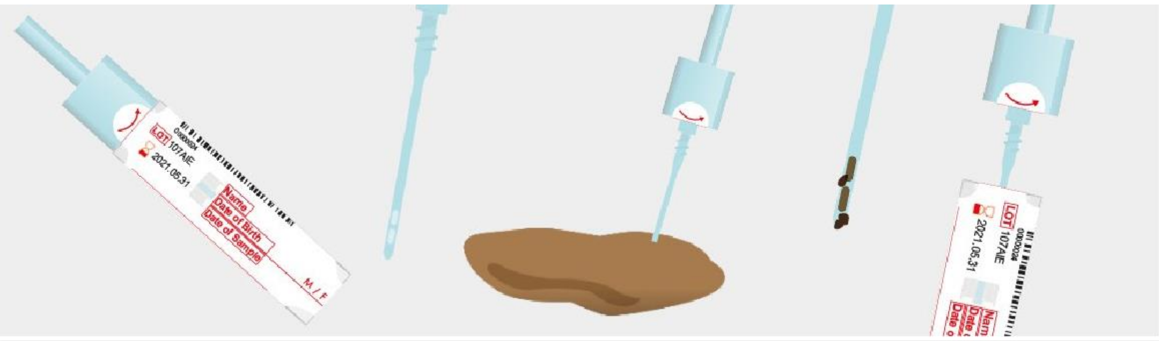

Figure 2.1. The faecal immunochemical test (FIT)

There is a wealth of literature on interventions aimed at increasing bowel cancer screening participation rates, however most of these interventions are not rooted in theory and do not perform well across different groups, which is why they only have a modest effect on increasing participation and intention (Goodwin et al., 2019; Myers, Goodwin, March, & Dunn, 2020, Tsipa et al., 2020). While designing interventions it is important to draw comparisons between groups as each group can be motivated by a different factor that could lead them to want to participate in a screening programme. For instance knowledge about bowel cancer and the screening programme was found to be a huge barrier that prevented people from lower SES groups to participate in bowel screening initiatives (Lasser et al., 2008); hence here an educational intervention would yield better results however this same phenomenon is not observed among people coming from affluent areas which means that the same educational intervention might not be as effective on this group. Bowel Cancer screening interventions are essential as they aim to improve uptake of these screening programmes which is an important priority for healthcare organizations across the globe. By 2030 Bowel Cancer Research UK has aimed to increase screening participation to ensure earlier diagnosis; they intend to double the rate of improvement in one-year cancer survival to match that of leading countries, this includes expanding the age range for screening to 50-74 and optimizing the Faecal Immunochemical Test (FIT) (Bowel Cancer Research UK, 2025). To achieve these goals and to improve overall health outcomes it is important to first understand what factors predict bowel cancer screening intention and behaviour across different groups. Alongside this, examining existing bowel cancer screening interventions would allow for a better understanding of what factors make certain interventions more effective than others and how these interventions can be made more inclusive for people coming from diverse backgrounds.

Chapter 3

Understanding Bowel Cancer Screening Intention and Behaviour across British, Indian, and Indian-Immigrant populations: A qualitative cross-cultural comparison

3.1 Abstract

Screening for Bowel Cancer reduces mortality. The National Health Service and the Indian Cancer Society run nation-wide free bowel cancer screening programmes; however, uptake remains low, especially among lower socioeconomic status groups. The purpose of this study is to gain insights into people’s beliefs about bowel cancer screenings. This was a cross-cultural study wherein 30 participants were recruited from across the UK and India. Reflexive thematic analysis was utilized. Five major themes were identified: 1) SES factors, 2) Need for awareness, 3) Need for education, 4) Test result anxiety and 5) Preventive healthcare mentality. Among Indian and Indian immigrant participants, education, awareness, and SES were closely linked to screening behaviour, while for British White participants, SES was the most influential factor. These findings suggest that both sociocultural and psychological factors shape screening decisions. Understanding these influences can inform the development of targeted interventions to improve screening uptake across diverse populations.

3.2 Introduction

Bowel (or colorectal) cancer occurs in the colon or rectum; it is the second leading cause of death from cancer in the United Kingdom and third highest cause of cancer related deaths in the world. In India, bowel cancer is the sixth most common cancer found among the Indian population, with an estimated 65,000 new cases reported every year (Indian Cancer Society, 2023). With such widespread reach of the disease, it becomes important to look at ways to manage the development of this disease and to reduce mortality rates across populations. An effective way to do this is to encourage early detection and screening. With the help of early detection, the survival rate for this disease can go up to 90% (Cancer research UK, 2020). There are various bowel cancer screening programmes that are made available by government agencies such as the NHS and the Indian Cancer Society. These tests are delivered free of cost and are designed to be accessible to the entire population

(WHO, 2022). In India colonoscopy is the primary method of bowel cancer screening whereas in the UK eligible patients are invited to complete a homebased guaiac faecal occult blood test. People over the age of 50 are considered eligible for bowel cancer screening and can avail the services provided by their healthcare system. Even though early detection plays such a crucial role in bowel cancer treatment, the uptake of these programmes remains an issue even after years of generating awareness (NHS, 2020).

Currently, different healthcare systems employ different strategies and interventions to boost uptake of such screening tests. The NHS, for example send out invitation letter every two years to the eligible population urging them to self-screen using the home test; this letter comes along with the instructions for the home test and some information about bowel cancer (NHS, 2024). Various health agencies also use different interventions to boost bowel cancer screening participation rates, these interventions incorporate various elements of behaviour change strategies to create a programme that could help improve uptake across groups. However certain sociocultural factors such as SES, fear of the screening outcome and lack of awareness about the screening initiatives may act as barriers to screening uptake (Tsipa et al., 2021). Other research has shown that lack of knowledge about bowel cancer and screening programmes was found to be a barrier preventing people from lower SES groups to participate in bowel screening initiatives (Lasser et al., 2008). Generally, it has been observed that most of these interventions are not rooted in psychological theory and do not perform well across different groups, explaining the modest effects on increasing participation (Goodwin et al., 2019; Myers, Goodwin, March, & Dunn, 2020, Tsipa et al., 2020). There have also been studies that target certain specific population groups and utilize culturally tailored interventions to help boost uptake; the culturally tailored intervention seems to be more effective than usual treatment or other behavioural interventions, however, uptake remains low (Katz et al., 2004).

Sociocultural factors such as cultural backgrounds, beliefs about healthcare and people’s level of education are associated with bowel cancer screening behaviour. Disparities have been observed in the participation rates among the population, with people belonging to lower SES groups displaying low screening behaviours, for instance the percentage of guaiac-based faecal occult blood tests (gFOBTs) uptake varies considerably across different groups, with the uptake being almost 61% among the least deprived areas and the uptake declining considerably to 35% among the most deprived areas (Palmer et al., 2014). These patterns are also prominent among members of ethnic minority groups, who are not always the focus of mainstream health research and hence their cause for non-participation remains elusive (Robb et al., 2008). Low participation rates among people belonging to lower SES groups and people who come from ethnic minority groups is also observed in India, where the uptake of bowel cancer screening is more among people who are educated and live in more affluent areas (Patil et al., 2017). Disparities have also been observed in screening behaviour among immigrants vs residents, with an interesting phenomenon being observed, where Indians living in the UK show better preventive health behaviours like participating in cancer screening than Indians living in India (Singh et al., 2002). With such disparities being observed in bowel cancer screening uptake among groups, it would be beneficial to explore the factors associated with bowel cancer screening intention across various groups, what bowel cancer screening interventions work well with different groups and what views people from diverse backgrounds hold about attending bowel cancer screening programmes.

As previous literature has shown bowel cancer screening behaviour varies among groups and hence being able to study this phenomenon across different populations would be useful in understanding how bowel cancer screening interventions can be made more effective to improve uptake. In most research studies especially, those centred around health and health interventions, researchers seem to concentrate on only one healthcare system and one population group, this may prevent comprehensive understanding of how these factors operate and manifest within different groups (Arnett, 2008). Cross-cultural studies of health in the context of bowel cancer have the potential to shed light on disease processes and on cultural phenomena and see how these may be related (Levenstein et al., 2001). Cross-cultural research studies also ensure that populations that are usually excluded from mainstream health research as well as population groups that are underrepresented in health research get the spotlight they deserve and enables researchers to understand the barriers and facilitators to bowel cancer screening across such minority groups (Crawford, 2017). This study aims to compare three different groups, namely White

British, Indian Immigrants living in the UK and Indians living in India. By comparing these distinct groups, we can understand how two distinct healthcare systems approach bowel cancer screening and what factors people coming from diverse background consider important while thinking about participating in bowel cancer screening tests.

In this study, semi-structed interviews will be used to understand: (a) people's attitudes towards bowel cancer screening, (b) barriers to screening, and (c) factors that may help to increase uptake. Beliefs that are held by Asian Immigrants about health serve as barriers towards healthcare and the social stigma carried by this population against health concerns like mental health disorders, prevent this population from seeking help for them. Beliefs about being discriminated against by healthcare professionals can also deter participation in the healthcare system. Lack of awareness about healthcare facilities also affect participation (Clough et al., 2013). Thus, by examining beliefs about CRCS held by minority groups we would be better equipped to design an effective intervention that would help promote bowel cancer screening intention across different groups. This study would also give us an opportunity to identify factors that predict bowel cancer screening intention by giving us the opportunity to examine participant's health decision making process.

3.3 Methods

3.3.1 Design

This study had a qualitative exploratory research design, that utilized semi-structured interviews to collect data across three groups. As this study delves into experiences of minority population groups that are usually underrepresented in health research and have not been studied in detail in this context before the interview schedule was curated in a way that encouraged the participants to engage in a discussion about bowel cancer screening and created a space for them to share their true views and opinions on the subject matter. One on one interviews were conducted via zoom and Microsoft teams. Some of the interviews were conducted in Hindi and were manually translated and the transcribed. Further information about the interview schedule along with the complete list of participant materials is provided in Appendix A 3.2-3.5.

3.3.2 Participants and Procedure

Ethical approval to conduct the study was granted to the authors (PSCETHS-691). Purposive sampling was used to recruit participants across the three population groups namely British Whites, Indian Immigrants living in the UK and Indians from India. We ensured that the sample was representative and inclusive of people coming from varied backgrounds and that there was an equal distribution of gender and other SES factors throughout the sample across the two countries. Thirty participants were recruited for this study (10 participants from each population group). Participants were only included if they were eligible for bowel cancer screening test in their country of residence (Being above the age of 50 for both countries). Participant demographic information is enclosed within Appendix A 3.1.

For this study participants were recruited from the UK and India. All interviews were conducted online, and participants were given the choice to have the interview in English or Hindi. Participants were recruited using online community groups (via social media) and with the help of local community centres. Consent forms and participant information sheets were sent to each participant via email before the interview. The interviews were recorded for data analysis purposes, and this was communicated to the participants in their consent forms before they agreed to participate in the study. The first author conducted these interviews using a semi-structed interview schedule that was iterative in nature and the flow of the questions was meant to create a smooth transition to the key questions the authors wanted to explore. A debriefing sheet was sent over to the participants to help them walk through the purpose of the study as well as to provide them with additional resources about bowel cancer screening.

3.3.3 Interview schedule

The questions in the interview ranged from gaging the participant’s overall level of awareness about bowel cancer screenings to exploring their inherent attitudes towards participating in bowel cancer screening tests and ended with allowing the participants the space to suggest ways to make bowel cancer screening initiatives more effective and inclusive. The complete interview schedule is available within Appendix A 3.2.

3.3.4 Data Analysis

Braun and Clarke's (2006) Reflexive thematic analysis was used to analyse the data. This framework guided the data collection process as well as the interpretation of the data itself. This process was selected as it helps the researcher to delve into factors that impact health decisions and to interpret the data and themes on a much deeper level. By truly understanding people’s perspective on bowel cancer screening, healthcare providers can understand and identify factors that need to be addressed to boost uptake among different groups. Within this study the researchers utilized both Latent and Semantic coding (Braun and Clarke,2006) as that seemed to the best way to approach the data. Therefore, themes in this study were double coded in accordance with the semantic meaning communicated by the participant, and the latent meaning interpreted by the researcher.

Authors ensured that the data analysis was guided by theory and was in accordance with Braun and Clarke's (2006) Reflexive thematic analysis method. Once the data was collected, the first author transcribed the interviews verbatim; the interviews conducted in Hindi were first translated into English by the first author and then transcribed accordingly. The first step taken in the analysis process was getting familiar with the data, the first author went through each transcript multiple times until the data felt familiar and known to the author. The next step was independent coding of the transcripts. The coding was done using an inductive approach to ensure that the codes and themes were grounded in data. The first author then came up with the code book which was then submitted to the second author for further deliberation and verification, after the consensus meeting the codes that were finalized were used to create the themes. Coding and creation of themes was done manually using an open approach during the initial stages of the analysis. Following the next steps of the Reflexive thematic analysis method potential themes were identified by the authors and then defined and finalized. A theme here was defined as something that has a certain level of pattern or meaning in relation to the research questions in the data (Karlsen et al., 2017). Caution was practiced ensuring that the themes and codes were rooted in data and identified and explained precise patterns observed within the data set. Once the themes were established, the identified patterns and overarching themes were then used to interpret and understand the unique experiences of the participants and their attitudes towards bowel cancer screening tests.

3.3.5 Reflexivity

The first author of this paper is an Indian Immigrant herself who is living in the UK; she also has a background of working as a clinical psychologist in India and has had firsthand experience with how the healthcare system works in India and the knowledge about how important it is to have equality in healthcare. The authors of this paper recognize that the first authors personal biases maybe reflected in the interpretation of the data; to combat this several precautions were taken. First one being the fact that special care was taken to ensure that the study sample is diverse and representative of people coming from all different backgrounds. Secondly, to avoid any potential biases, study transcripts as well as the code book and the subsequently arising themes were reviewed and verified by the other authors to prevent the first author's personal experiences impacting the data analysis and interpretation.

3.4 Results

Five themes were generated from the data set. These overarching themes reflected barriers and facilitators of bowel cancer screening and were a product of the participant's own experience with bowel cancer screening. Each theme was individually analysed, and comparisons were drawn between and within different population groups. The five themes identified were: 1) Test Results Anxiety,2) Need for Awareness, 3) Need for Education, 4) Preventive Healthcare mentality and 5) SES. These themes help us understand factors people consider when they think about partaking in bowel cancer screening programmes. The themes encompassed various subthemes that helped in the development of the themes and help link the participant's experiences with the research questions. Eight subthemes were identified. The subthemes are displayed in figure 3.1, along with their corresponding theme.

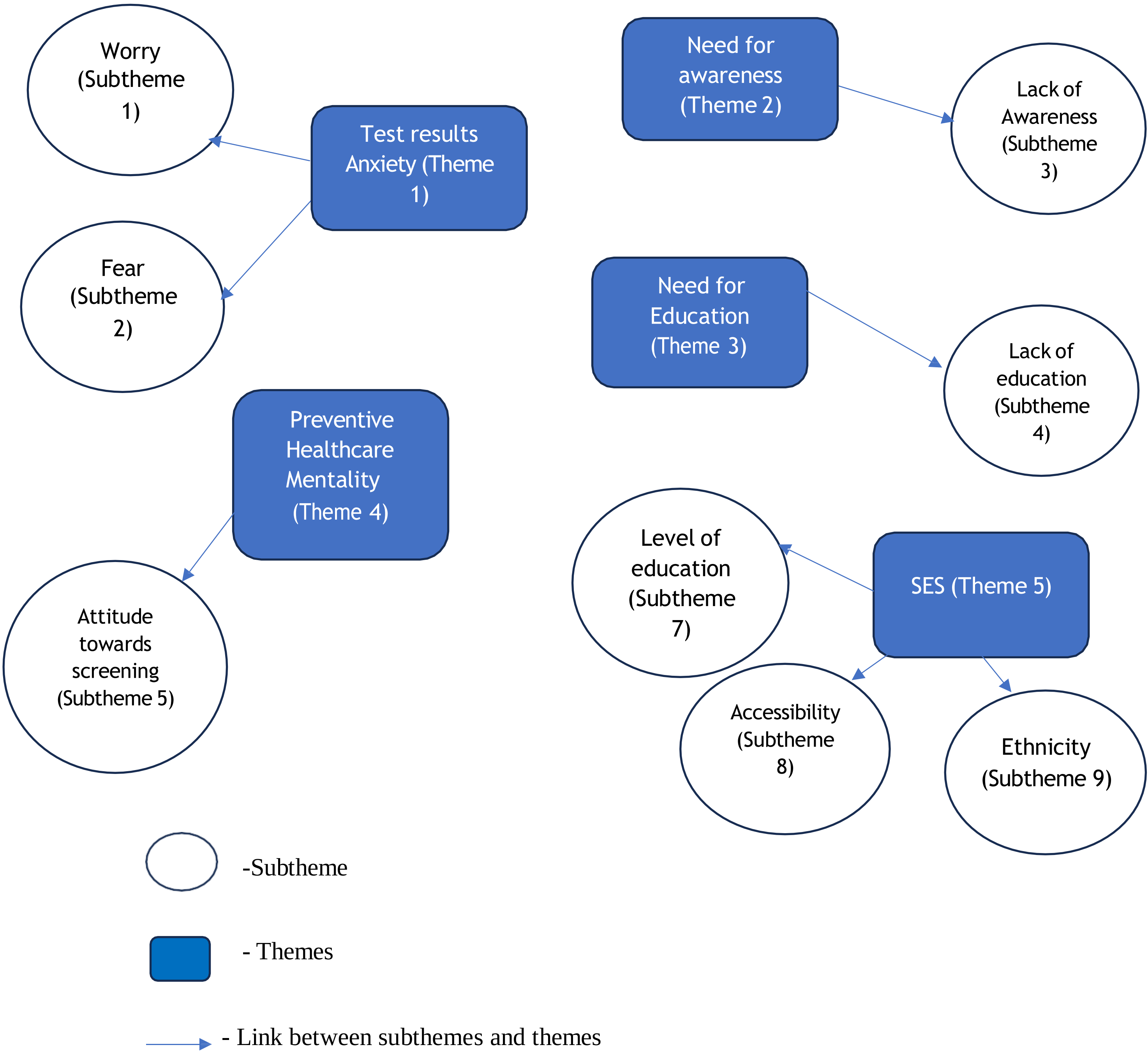

Figure 3.1 Theme Map

Test Result Anxiety

Worry about the test results-Worries associated with the test results especially in the case of a positive test result were found to impact the decision to participate in bowel cancer screening. Participants voiced their worries around waiting for the results and the inevitable worry about receiving a positive test result indicating the presence of bowel cancer. Participants also echoed worry regarding their family members and having to put their family through this stressful experience. They also reported being worried about what would happen to their families if they were diagnosed with Bowel cancer. Many participants reported this as being a deterrent towards participating in bowel cancer screening programmes. This feeling of worry was observed across all three population groups. Among White British this worry was seen to be associated more with personal well-being wherein the participants worried about finding out that they are sick whereas in both the Indian origin groups the worry was associated more with the well-being of their family and loved ones.

Some participants also spoke about getting a routine screening as “unnecessary” worry which can be avoided. This attitude was especially prominent among the Indian population where traditionally preventive healthcare practices like getting regular health screenings and checkups are seen as unnecessary and are not traditionally encourage by the Indian healthcare system.

“If I get tested, I would be too worried about the results and my wife would also worry about the test results, I do not want to stress her out for no reason.”- Participant 16 (Indian Participant from India).

“I am healthy, I do not have any symptoms, and I do not want to spend days worrying about cancer and going to a hospital and getting tested also seems like a hassle.” Participant 1 (Indian participant from India)

Fear- Participants also reported a sense of fear about getting a positive result and what that would mean to them and their family. Participants spoke about the fear associated with getting a cancer diagnosis as well as the treatment. Fear associated with what their lives would look like after receiving a positive test result seemed to discourage participants from getting screened. Participants in the British White population group who had a record of being screened reported that they had to combat this fear and push it away to open themselves up to the idea of getting screened. In other population groups, participants seemed to struggle when it came to overcoming this fear; with many reporting strong family ties and fears about what would happen to their families after them as being the reasons for holding on to this fear.

It should also be noted that fear surrounding bowel cancer screening was closely intertwined with fatalistic beliefs about cancer outcomes. Fatalism, characterised by the perception that a cancer diagnosis inevitably leads to severe suffering or death and that individual action cannot alter this outcome, appeared to amplify fear and discourage engagement with screening. Such beliefs may reduce perceived personal control and coping efficacy, leading individuals to avoid screening as a means of managing emotional distress rather than confronting potential risk. This phenomenon is particularly relevant within culturally diverse contexts, where fatalistic beliefs about illness may be shaped by prior experiences with the healthcare system, social beliefs and perceptions surrounding healthcare and screening, and limited exposure to preventive healthcare.

“To be honest I do not think I would be up for it. I am aware of the benefits, but cancer is just scary business. Cancer diagnosis is life ending you know. I guess I

never really want to spend time thinking about something so unpleasant."- Participant 24 (Indian Immigrant living in the UK).

Need for Awareness

Lack of awareness- Many participants especially those coming from lower SES groups reported a lack of awareness about such services being offered by medical agencies as a barrier towards screening. Many participants from India reported that they were not even aware that such screenings exist let alone the fact that they are available in Government hospitals. In the two population groups observed within the UK, participants seemed to be aware about the bowel cancer screenings held by the NHS. Many participants from the UK across both the groups who seemed to have participated in the screening stated that they did so as it is a service offered by the NHS and hence that means it was important. In contrast, almost all the participants from India reported the need for awareness drives and materials as means to promote bowel cancer screening participation and that The Indian Cancer Society needs to make people aware that such screenings exist within the Indian medical system. Overall, participants across all groups reported that promoting awareness about the benefits of attending bowel cancer screening programmes could help promote uptake as well as motivate them to get tested as well thereby making bowel cancer screening awareness a major factor impacting participation rates across both countries. Some participants also reported that becoming aware of such services has motivated them to now get tested.

"Oh, the first step has to awareness. I am an educated man; I even go to the GP whenever I sense I need to and even I was not aware of such tests. I think more efforts need to go into promoting this, if bowel cancer screening is targeted towards older generations, then having ad campaigns on TV should do wonders."- Participant 1 (Indian Participant from India).

Need for Education

Lack of education regarding bowel cancer screening- A need for education was reported across the different participant groups. Participants seemed to lack education in the context of the importance of bowel cancer screening and the benefits of early detection. Participants who did opt for the screening seemed to have a better understanding about the importance of catching bowel cancer early and seemed to have educated themselves about bowel cancer screening and how early detection reduces mortality rates.

Participants from the UK suggested making changes to the current NHS bowel cancer screening invitation letter to account for the need for education and early detection. Participants in these groups felt like the NHS screening invitation letter does not quite convey the importance of getting screened and does not educate the reader about the cons associated with not getting screened. Participants from India also echoed similar sentiments with most participants reporting a need for educational interventions carried out by the government to make people realize the lifesaving effects of screening.

"I think education plays a big role in this. When I think about my own reasons for participating in bowel cancer tests a big reason that stands out is the fact that I read a lot of medical research articles and papers, so I am well aware about the benefits of early detection."- Participant 15 (British White Participant).

"The letter itself needs some modification; currently it only includes instructions for the test and some basic information but if someone is not already aware of the benefits of getting tested, I can see them easily throwing the invitation away."- Participant 22 (British White Participant).

Preventive Healthcare Mentality

Attitude towards screening- Some participants reported having negative attitudes towards screening and engaging in preventive healthcare practices. This phenomenon seemed to be more prevalent among people coming from an Indian background. Participants here reported a more casual attitude towards preventive healthcare services and a reliance on the appearance of symptoms to get tested for a disease. On the other hand, British White participants seemed to have a positive attitude towards screening, and they attributed this to the fact that the NHS promotes regular health check-ins and makes them aware about the various screenings they need to participate in at various phases of life. Participants who did participate in bowel cancer screening programmes across all three groups seemed to have an overall positive attitude towards screenings.

Participants who took the time out to educate themselves about bowel cancer or who have always maintained a healthy lifestyle seem to be on top of their screening practices. Participants who have had personal experiences with bowel cancer also seem to be motivated to get screened. Participant's personal attitude towards screening in general therefore seems to impact their bowel cancer screening behaviour. Having colonoscopies as a primary way of getting screened in India also impacts the attitude people have towards screening, with participants reporting it as a dreadful thought.

"For me I guess it was more like signing up for a pap smear or mammogram, after a certain age you have to do some things, so it makes sense to do so."- Participant 11 (British White participant).

"If I was being completely honest, I do not think I would get tested, I mean if I had any symptoms then I would definitely go to the doctor and get checked and do all that but otherwise it is just like almost being paranoid"-Participant 20 (Indian Participant from India).

Socioeconomic Factors (SES)

<u>Educational Qualification-</u> Educational qualification of the participant seemed to contribute towards screening participation rates. Participants who have been screened in the past and continue to screen for bowel cancer seem to hold good jobs and have a high level of education. Participants themselves attributed their screening behaviour to their educational background. Participants who did not receive a high educational qualification seem to be less keen towards participating in bowel cancer screening initiatives and lack the awareness needed to understand the benefits of screening and early detection. Level of education here seems to facilitate the uptake of bowel cancer screening, and this was observed across all three groups.

"I think my job and my time spent studying health research made me more aware of participating in health research and going to screenings. I think the only way to ensure that public services keep getting better is through going and participating in just screenings, give the medical community the data so that they can learn more about our needs and the disease itself, thus serving us better."-Participant 28 (British White Participant).

“As a doctor myself I think I am well versed with the importance of early detection in cancer prognosis as well as the important of attending these regular screenings. It is better to catch something in its early stages then suffer later on. I think I will continue attending these screenings till I am no longer able to.”- Participant 17 (Indian immigrant living in the UK).

Accessibility-Across the different participant groups, it was observed that access to the screening test itself seemed to be a big factor that predicted people’s participation intention. Participants within the UK spoke about the convenience of having the FIT test as an option that makes it easy to participate in the screening. On the other hand, in India where the FIT test is not the norm and isn’t readily available, participants mentioned the thought of going through the colonoscopy procedure and having to go to the doctors in the first place to be a stressful process and acting as a hindrance towards participation. The general accessibility to healthcare services and regular check in done by the NHS also seemed to facilitate participation. UK participants also noted how convenient it is to have the test sent to them whereas in India patients must go to the doctor and ask for the test which creates inconvenience and, in some cases, causes them to miss a day at work which for some people there could be a hard thing to justify especially if they work a daily wage job. It would therefore be helpful if the home FIT test was made readily available across India.

“I think the biggest one is how reachable the NHS is, they have regular checkups, the app asks for updates, they send letters, it feels like they are keeping track of your health here whereas back home you have to approach the system for everything.”- Participant 11 (Indian Immigrant living in the UK).

“It is hard work to go to the hospital and get the test done, if I wanted to participate in it, I would need to miss a day’s work. I frankly cannot afford to miss work like that. I live pay check to pay check and work in the service industry; my boss would not let me take the days off either.” – Participant 9 (Indian Participant from India).

Culture- Additionally, culture seems to play a role in the way people approach bowel cancer screening. In Indian culture with preventive healthcare measures not seeming to hold a lot of importance, participants from India seem to have a more symptom-associated outlook towards healthcare. On the other hand, British white participants seemed to approach screening in a more favourable manner with them being more open to getting screened to prevent health issues later on in life. In the case of Indian immigrants while some spoke about going to the GP's office only if they are unwell; others noted that since being a part of the NHS and getting used to more regular check-ins and contact from the NHS has made them notice a shift in their own attitude and has made them more open to getting screened and adopting a healthier lifestyle.

Additionally, in Indian culture with religion being a huge part of a person's daily life, participants reported that they relied on their belief in God to keep themselves healthy and participants spoke about avoiding thinking about cancer to not put it out there in the universe. It was also observed that with Indian participants their family played a huge role in them getting screened, acting both as a facilitator and a barrier.

"When my dad got diagnosed, we were all in such bad place, I kept thinking that had he been on top of his health we would not have to suffer this way, I never want to do that to my kids."- Participant 19 (Indian participant in India).

<u>Gender-</u> Gender of the participant seemed to impact their participation in the bowel cancer screening initiative. Across the three groups women were more receptive towards attending the screening with many stating that since they do attend regular screening for other disorders like Breast cancer and cervical cancer, adding bowel cancer screening to their rotation did not seem like a huge change. Since women tend to start attending medical screening for different reasons from a younger age, they seem to be more prepared to participate in bowel cancer screening and seem to take the invitations to participate more seriously, whereas for many men bowel cancer screening is their first ever screening experience which is why some of them seem to be more reluctant to participate.

"My wife is good about all this screening stuff, she goes for her mammography every year, for me I need to take effort to remember to do this as this is the only one, I need to attend" (British White).

3.5 Discussion

3.5.1 Key findings

The findings of this study help to identify the perceived barriers and facilitators towards participating in bowel cancer screening tests across different population groups. This study has four key findings, one of the most important ones being how a person’s cultural background and beliefs interact and impact healthcare decisions like participating in bowel cancer screening programmes. By comparing two different countries and three different population groups we can understand how sociocultural and psychological factors impact bowel cancer screening uptake. The way these factors manifest among the different population groups are also impacted by the participant’s sociocultural background thereby stating the importance of addressing these factors to boost uptake.

Another key finding was a strong need for awareness and educational interventions; this was more prominent among participants from India who noted that not being aware of such services acts as a barrier towards getting screened. Participants reported a lack of educational materials being provided to the people by the authorities in India, on the other hand, NHS sending bowel cancer screening invitations out to everyone who is eligible, boosts people’s awareness about the existence of the test. The need for education however, seemed to be an overarching theme; participants from the UK spoke about how the material within the NHS invitation letter alone is not sufficient to establish the importance of getting screened thereby making it easy to ignore.

Additionally, it was found that participant’s ethnicity and cultural values contribute towards their decision to get screened. Attitudes towards preventive healthcare was found to be a major influence on whether someone would get screened. Previous studies have indicated that cultural attitudes towards health check-ups and screenings act as a major determinant of screening behaviour (Kwok et al., 2016). Thus, having culturally tailored bowel cancer screening interventions could lead to better participation rates among different ethnic groups by targeting any biases the group might have towards getting screened.

An unexpected finding was that Indians living in the UK had more favourable attitudes towards bowel cancer screening and were more open towards participating in screenings compared to Indians living in India. One potential reason could be the fact that Indian immigrants reported that the timely health check-ins that the NHS provides as well as the fact that the test is being sent to them at home makes it easier for them to keep track of their screenings as well as motivates them to participate in it. This phenomenon has been touched upon in a few past studies wherein it was found that Indian immigrants have better health outcomes as well as more favourable attitudes towards screening behaviours due to the availability of more active healthcare system as well as education regarding preventive healthcare services (Austin et al., 2009; Szczepura et al., 2003).

3.5.2 Study Strengths

A key strength of this study is cross-cultural comparison, which allows for more diverse study data and comparisons to be made across different populations. Factors such as lack of education and awareness especially among lower SES groups could explain why participation rates are lower for such groups. The qualitative approach of using semi-structured interviews creates a space for the participants to voice their thoughts on bowel cancer screening programmes freely and allows them to dive deep into their inner believes about bowel cancer screening tests and their participation in such tests. The qualitative data also provides insights into what factors could predict participation and how bowel cancer screening interventions can be made more effective and inclusive to improve uptake and promote health equality.

3.5.3 Study Limitations

There are limitations to the present study. Since this study only observed specific population groups (Indians, Indian immigrants living in the UK and British whites), it would be hard to generalise the results of this study. Future studies could focus on comparing a wider population and could look at Immigrant health outcomes across different countries to get more insights into screening behaviour patterns. Whilst a qualitative approach enables a rich and varied understanding of the participant’s experience and the factors associated with screening, quantitative studies are needed to understand and identify the predictors of intention.

3.5.4 Study Implications

Since this study explores the screening behaviour of minority groups; the qualitative data derived from this study enables researchers to develop interventions that can boost uptake among such groups. It is especially useful to look at the experiences of participants from India given there are currently few studies in this cultural context. Through the data obtained from India it can be seen how even though the screening test is made available throughout the country for free across the multiple government hospitals, there are gaps and problems in the system that the healthcare providers need to fix to make the tests truly accessible to all.

Findings from the present study can be used to inform future bowel cancer screening interventions that serve people coming from varied sociocultural backgrounds. Such information could help policy makers to fix the underlying issues that people have with the existing services that are currently employed by the NHS and the Indian Cancer Society, thereby improving uptake across different population groups. A good starting point would be working on more educational interventions, making these tests more accessible in India with having the option for at home FIT tests could also help boost the uptake of such screening tests. More research is required on understanding how bowel cancer screening interventions could be made more culture specific and how the healthcare system can shift from a ‘one size fits all’ approach to a more inclusive way of operating.

3.5.5 Conclusion

Our findings emphasise the importance of understanding and acknowledging sociocultural factors when designing healthcare interventions. By shedding light at population groups that are not usually the focus of mainstream health research; researchers are better able to understand what factors impact their health decisions and how these factors can be adequately addressed in interventions to boost uptake among minority groups. By identifying key factors that participants themselves have outlined as factors that could encourage them to get screened, it is hoped that this study can help to understand how to improve future bowel cancer screening interventions and campaigns to boost uptake.

Chapter 4

Psychosocial predictors of bowel cancer screening intention and behaviour: A systematic review and meta-analysis

4.1 Chapter Overview

Building on the qualitative insights from Study 1 (Chapter 3) (themes of need for awareness, education, fear, and sociodemographic factors) and the theoretical background established within Chapter 1, this chapter advances the thesis aim by quantifying which predictors matter most when it comes to screening. To achieve this, we present a systematic review and meta-analysis of psychosocial predictors of bowel cancer screening behaviour and intention, identifying key predictors across different settings and connecting these with the empirical work in later chapter.

Searches as well as the review followed PRISMA guidelines along with a PICOS-driven search strategy (PsycINFO and Cochrane Library; English-language peer-reviewed studies) and explicit inclusion criteria for intention or behaviour outcomes; screening and extraction procedures are detailed in the Methods section. The final model comprised 84 unique studies (1980's–2025) contributing effects to intention (*k*= 32) and behaviour (*k*= 52), with seven studies reporting both. Results show how Motivational predictors like Knowledge (*r* =.18), Subjective Norms (*r* = .15) and Perceived Benefits (*r* =.18) reliably increase intention while Volitional factors like Self-Efficacy, was found to be the most consistent correlate of behaviour (r=.16); Perceived Severity acts as a modest predictor (*r* =.08); Perceived Barriers suppress behaviour (*r* = −.13) and are weaker for intention. The intention-behaviour link is positive overall, where intention is found to be a significant predictor of screening behaviour (*r* =.17).

Together, these findings align with the thesis objectives set out in Chapter 1 and directly inform the quantitative predictor study in chapter 5 as well as the interventions review by specifying which constructs to prioritise (knowledge/perceived benefits to build intention; self-efficacy and barrier-reduction) to drive uptake.

4.2. Introduction

4.2.1 Background

Bowel cancer remains one of the leading causes of cancer morbidity and mortality worldwide, despite the existence of highly effective screening programmes (Arnold et al., 2017; Sung et al., 2021). Screening can detect precancerous lesions or early-stage cancers when treatment is most effective, substantially reducing mortality (Mandel et al., 1993; Hewitson et al., 2008). Yet participation in bowel cancer screening programmes remains suboptimal, with uptake rates rarely exceeding 65% in organised systems such as the UK National Health Service (NHS) Bowel Cancer Screening Programme and much lower in certain demographic and ethnic subgroups (Lo et al., 2015; Kerrison et al., 2016). The persistence of low uptake despite the availability of free or subsidised screening tests underscores the need to understand the psychological, social, and demographic predictors that influence both screening intention and actual participation.

4.2.2 Importance of Identifying Predictors of Bowel Cancer Screening

Behavioural science has long recognised that health behaviours such as cancer screening are not determined solely by knowledge of disease or access to services, but by a complex interaction of cognitive, motivational, emotional, and contextual factors (Glanz & Bishop, 2010; Weinstein, 1993). Intention which refers to the motivational readiness to perform a behaviour, is consistently highlighted as a proximal determinant of health action, yet intention often fails to translate into behaviour, a phenomenon known as the “intention–behaviour gap” (Sheeran, 2002). Identifying the psychosocial and demographic predictors of bowel cancer screening behaviour and intention is therefore crucial not only for refining theoretical models of health behaviour but also for designing targeted interventions that can effectively increase cancer screenings.

Previous literature has suggested that constructs such as self-efficacy, perceived benefits, perceived barriers, and perceived susceptibility are recurrent predictors of screening outcomes (Janz & Becker, 1984; Champion & Skinner, 2008). However, findings across studies are inconsistent, with effect sizes varying by context, population, and measurement. Moreover, many individual studies are underpowered to detect small-to-moderate associations, and existing reviews are largely narrative rather than meta-analytic (Gimeno García, 2012). This limits the ability to draw generalisable conclusions. A comprehensive quantitative synthesis is therefore required to determine which predictors reliably influence bowel cancer screening outcomes across diverse contexts.

Two theoretical models are particularly prominent in research on cancer screening predictors: the Health Belief Model (HBM) and Protection Motivation Theory (PMT). Both frameworks emphasise cognitive appraisals of health threats and coping responses, yet they differ in scope and predictive emphasis. The HBM, originally developed in the 1950s, proposes that health behaviours are shaped by perceptions of susceptibility, severity, benefits, and barriers (Rosenstock, 1966). Applied to bowel cancer screening, individuals are expected to participate if they believe they are personally at risk (susceptibility), regard bowel cancer as a serious disease (severity), perceive screening as beneficial (benefits), and encounter few logistical or psychological obstacles (barriers). Over the decades, the HBM has provided a useful heuristic for structuring health interventions (Champion & Skinner, 2008), and many screening interventions have drawn on its constructs to tailor messages (Myers et al., 1994). However, critics note that the HBM treats behaviour largely as a static decision rather than a dynamic process. HBM does not explicitly incorporate intention or self-efficacy, and has yielded mixed empirical support (Carpenter, 2010). Meta-analyses across health behaviours suggest that perceived barriers and benefits are more consistent predictors than severity or susceptibility (Janz & Becker, 1984), but effect sizes are typically small of the included studies, and the model alone often fails to account for the volitional aspects of behaviour change.

Protection Motivation Theory (PMT) (Maddux & Rogers, 1983; Rogers, 1975) extends beyond the HBM by explicitly incorporating coping appraisal and self-efficacy. PMT posits that protective behaviour results from two parallel cognitive pathways: threat appraisal (perceived severity and vulnerability) and coping appraisal (response efficacy, self-efficacy, and response costs). In screening contexts, threat appraisal reflects beliefs about bowel cancer risk and seriousness, while coping appraisal reflects beliefs about the effectiveness of screening, one’s ability to complete the test, and the perceived costs of participation. Empirical evidence increasingly supports the greater predictive utility of coping appraisal variables, particularly self-efficacy, over threat appraisal in explaining health behaviours

(Floyd et al., 2000; Milne et al., 2000). For example, studies in mammography, cervical screening, and faecal occult blood testing consistently show that individuals who feel confident in their ability to navigate screening logistics are more likely to participate (Katapodi et al., 2004; Rawl et al., 2001). In the bowel cancer domain, self-efficacy has been associated with both intention to screen and actual uptake, whereas severity and susceptibility often show weaker or inconsistent effects (McQueen et al., 2008).

4.2.3 Empirical Evidence on Predictors of Screening Behaviour and Intention

Self-Efficacy

Self-efficacy is the belief in one's ability to perform a behaviour despite barriers or challenges (Bandura, 1997). In bowel cancer screening, this may involve confidence in handling faecal samples, mailing kits, or attending invasive procedures. Multiple studies demonstrate that self-efficacy is a robust predictor of both screening intention and behaviour (Jones et al., 2010; O'Carroll et al., 2015). Importantly, self-efficacy not only predicts uptake but also moderates the effect of intention, helping to bridge the intention–behaviour gap (Sheeran & Webb, 2016).

Perceived Barriers

Barriers ranging from practical issues (time, cost, inconvenience of attending screening) to psychological factors (embarrassment, disgust) are consistently reported as negative predictors of screening uptake (Moser et al., 2009; von Wagner et al., 2011). While some barriers may be structural, others are perceptual and amenable to intervention. Studies suggest that reducing perceived barriers can yield significant improvements in screening participation (Klabunde et al., 2005).

Perceived Benefits

Perceived benefits capture beliefs about the positive outcomes of screening, such as early detection, peace of mind, or reassurance (Champion & Skinner, 2008). Several studies link higher benefit perceptions with stronger intentions to screen (Kiviniemi et al., 2011; Rawl et al., 2001). However, the strength of this association with actual behaviour is less consistent, possibly because motivational beliefs require volitional resources to be enacted (Conner & Norman, 2015).

Perceived Severity and Susceptibility

Perceptions of severity (seriousness of bowel cancer) and susceptibility (likelihood of developing it) have long been theorised as motivators of screening. Yet empirical evidence suggests their predictive power is modest. While individuals often acknowledge the seriousness of cancer, this alone does not compel them to act (Weinstein, 1988). Susceptibility perceptions may be discounted due to optimism bias or fatalism (Clarke et al., 2000). Thus, while severity and susceptibility remain central to HBM and PMT, their empirical contributions appear weaker compared with coping constructs such as self-efficacy and response efficacy, which typically demonstrate larger effect sizes in predicting screening behaviour and intention.

Knowledge and Demographics

Knowledge of bowel cancer and screening procedures is a necessary but insufficient condition for uptake. Knowledge predicts intention but translates less reliably into behaviour without supportive coping factors (McCaffery et al., 2002). Demographic variables such as age, gender, ethnicity, and socioeconomic status also influence screening but typically through indirect pathways. For instance, lower uptake among minority ethnic groups often reflects informational and structural barriers rather than ethnicity per se (Lo et al., 2015)

Intention

Intention is widely recognised as the most immediate and proximal determinant of behaviour across social cognition models (Ajzen, 1991; Sheeran, 2002). In the context of bowel cancer screening, intention reflects a person’s readiness or plan to participate, often operationalised as willingness to complete faecal immunochemical testing or attend colonoscopy. While intention is consistently associated with subsequent uptake, it does not guarantee follow-through, giving rise to the well-documented “intention–behaviour gap” (Sheeran & Webb, 2016). Understanding which psychosocial predictors influence screening intention is therefore critical: predictors that increase intention but fail to translate into behaviour may highlight motivational drivers, whereas those that strengthen both intention and behaviour may represent more potent intervention targets. By examining intention alongside behaviour, this review is able to distinguish motivational from volitional predictors, clarifying the pathways through which psychosocial and demographic factors influence screening participation.

Subjective Norms

Within bowel cancer screening, subjective norms can foster motivation by framing screening as a behaviour that is socially approved or encouraged. Empirical studies suggest that subjective norms are more consistently related to screening intention than to actual uptake, reflecting their role as motivational drivers rather than volitional enablers (Bianchi et al., 2024; Scaglioni et al., 2023). While the direct impact of norms on behaviour is modest, they contribute indirectly by strengthening intention, which is a key proximal determinant of action. Social influence interventions such as physician recommendation or culturally tailored community campaigns therefore hold potential to enhance intentions and, indirectly, participation.

4.2.4 Limitations of existing Literature

Despite a substantial body of research on psychosocial predictors of bowel cancer screening, existing reviews are limited in several important ways. Many syntheses have been largely narrative rather than quantitative, summarising predictors descriptively without estimating pooled effect sizes, as would be expected in traditional meta-analyses (Gimeno Garcia, 2012). Narrative reviews are useful for identifying broad themes, but they cannot determine whether observed associations are reliable across diverse contexts or whether some predictors consistently outperform others. Moreover, prior reviews often aggregate across cancer types (e.g., mammography, cervical screening, prostate cancer) without distinguishing the unique challenges of bowel cancer screening, such as disgust, embarrassment, or logistical barriers related to faecal sampling (Jones et al., 2010; von Wagner et al., 2011).

Another limitation is the focus on single predictors in isolation, rather than a comparative synthesis. For example, while some studies highlight the role of perceived susceptibility, others emphasise self-efficacy or barriers, but few reviews evaluate these constructs against each other in the same analytic framework. This makes it difficult to establish relative importance. Similarly, demographic predictors such as age, ethnicity, and socioeconomic status have often been treated as confounders rather than variables of substantive interest, even though they may illuminate structural inequities in screening participation (Lo et al., 2015; Kerrison et al., 2016).

Furthermore, most prior reviews have not incorporated advanced methods for dealing with heterogeneity or publication bias. High heterogeneity is common in behavioural science meta-analyses because of differences in populations, measurement, and contexts, but without quantitative synthesis it remains unclear whether the observed variation reflects true population differences or simply sampling error (Higgins et al., 2003). Publication bias is another concern, as studies with null findings may be less likely to be published, potentially inflating observed associations (Rothstein et al., 2008). These methodological gaps highlight the need for a rigorous meta-analytic review.

The current review addresses these gaps by conducting a comprehensive meta-analysis of psychosocial and demographic predictors of bowel cancer screening intention and behaviour. By focusing specifically on bowel cancer rather than general cancer screening, this review accounts for the unique behavioural demands and psychological responses associated with faecal and colonoscopy tests. This specificity is important because screening contexts vary in their demands: mammography requires clinic attendance, while bowel cancer screening often involves at-home faecal sampling and return by post, which introduces distinct volitional and emotional challenges (Chapple et al., 2008; Weitzman et al., 2001). Focusing on predictors is also relevant given the recognition that behavioural interventions are most effective when targeted at modifiable psychological determinants (Michie et al., 2011; Noar et al., 2007). By clarifying which predictors are consistently linked with screening outcomes, this review provides actionable insights for intervention design. For instance, if self-efficacy emerges as the strongest predictor of behaviour, interventions should prioritise skills training and confidence-building strategies. If barriers exert the largest negative effect, structural and perceptual barrier-reduction strategies will be essential.

Situating the review within theoretical frameworks adds explanatory value. The HBM is widely applied in cancer screening including bowel cancer but reviews and meta-analyses indicate that benefits/barriers outperform severity/susceptibility, and that coping/volitional constructs (e.g., self-efficacy) central to PMT often show the largest effects on behaviour and intention (Carpenter, 2010; Floyd et al., 2000; Hedayati et al., 2023; Jones et al., 2014; Lau et al., 2020; Lemmo et al., 2023; Milne et al., 2000). PMT, with its explicit inclusion of self-efficacy and coping appraisal, offers a more comprehensive account of why individuals do or do not follow through on screening intentions. By synthesising evidence on both HBM constructs (susceptibility, severity, benefits, barriers) and PMT constructs (self-efficacy, response efficacy, response costs), this review allows for a direct comparison of the explanatory power of these models in the bowel cancer context. Theoretically, this review also speaks to the long-standing debate between motivational and volitional determinants of health behaviour (Schunk & DiBenedetto, 2020). HBM constructs are largely motivational (what makes individuals want to screen), while PMT's coping constructs are more volitional (what enables them to act). By examining predictors of both intention and behaviour, the review can test whether motivational factors predict intention more strongly, and volitional factors predict behaviour more strongly, thereby refining theoretical models.

4.2.5 Chapter Aims

The primary aim of this review is to synthesise and examine the associations between psychosocial predictors and bowel cancer screening outcomes, with a focus on both intention and behaviour. Specifically, the review seeks to:

1. Identify the key psychosocial predictors (self-efficacy, perceived barriers, perceived benefits, perceived severity, perceived susceptibility, and knowledge) of screening intention and behaviour.
2. Evaluate the contribution of demographic predictors such as age and ethnicity in predicting screening outcomes.

In addressing these aims, this review provides a comprehensive synthesis of the psychosocial determinants of bowel cancer screening participation. The results will not only refine theoretical models of health behaviour but also provide practical guidance for the design of interventions and policies to increase screening uptake.

4.3. Methods

4.3.1 Search Strategy

This review is reported in line with the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) guidelines. The review was preregistered on PROSPERO: CRD42024561729 (attached within the Appendix B 4.1). The search strategy was developed based on the Participants, Interventions, Comparisons, Outcomes, Study design (PICOS) framework. All study designs where a cohort of at least 10 participants were studied were eligible for inclusion in this review. For the intervention studies we only extracted data from the non-interventional group. Correlational studies and cross-sectional studies were also included. Studies were included if they incorporated screening intention or behaviour in terms of willingness to participate in bowel cancer screening tests like the Faecal Occult Blood Test (FOBT), Faecal Immunochemical Test (FIT), Flexible Sigmoidoscopy (FS), colonoscopy or barium enema. Studies were excluded if they were an abstract presented in a conference, a dissertation, a protocol, a poster presentation, a think-piece, or guidelines. Studies were excluded if they were not reported in English. Studies that did not report statistics in the results or were subset or secondary analyses to previous papers, were excluded. Studies were excluded if they did not examine predictors of bowel cancer screening intention or behaviour quantitatively. We searched the following databases- PsycINFO (1806-) and The Cochrane Library. Searches were restricted to articles in the English language (See figure 4.1 for the PRISMA diagram and see Appendix B 4.3 for search terms).

Studies were included if they examined predictors of bowel cancer screening intention or behaviour, for example, studies assessing whether self-efficacy impacted screening intention across different groups. Eligible studies were required to report a clearly defined analysis where effects of a psychosocial predictor like age or perceived benefits was observed on either screening intention or behaviour. When studies reported multiple subgroups, effect sizes from each subgroup were combined into a single composite score weighted by subgroup sample size. Where studies included multiple time points, a single effect size was derived to avoid duplication. After duplicate publications were removed, one author (SS) pre-screened all titles and abstracts against inclusion criteria. A second author (GW) independently reviewed 10% of abstracts and titles for quality assurance. Full-text articles were then assessed by SS, with 10% independently checked by GW. Agreement between reviewers was 100% at both screening stages. All data analyses were conducted independently by two authors (SS, AZ), with disagreements resolved through discussion.

Data Extraction

Quantitative information was extracted using a standardised, pre-piloted data extraction form developed through Cochrane for cohort studies (Appendix B 4.2). Where necessary, study authors were contacted to provide clarification or additional details. Risk of bias was assessed by SS (Appendix B 4.4). Risk of bias was assessed using the Appraisal Tool for Cross-Sectional Studies (AXIS) (Downes et al.; 2016), which is specifically designed for survey-based and non RCT based research and was therefore appropriate for the non-randomised, cross-sectional studies included in this review. The AXIS tool evaluates methodological quality across key domains including study design, sampling strategy, measurement validity, reporting quality, and ethical considerations. 67% (n = 56) of studies were classified as low risk of bias, demonstrating clear study aims, appropriate recruitment strategies, justified sample sizes, and validated outcome measures. Moderate risk of bias was identified in 19% (n = 16) of studies, typically due to limited reporting of sampling frames, non-response bias, or inadequate consideration of confounding variables. The remaining 14% (n = 12) of studies were rated as high risk of bias, often due to insufficient methodological transparency or reliance on self-report measures without validation. Although most studies met acceptable methodological standards, variability in study quality indicates that results should be interpreted with caution. Sensitivity analyses were conducted to assess the potential impact of study quality on overall findings.

Extracted data included: study characteristics (year, country, design, and setting); sample characteristics (size, age, gender and other demographics); type of bowel cancer screening assessed (e.g., faecal occult blood test, faecal immunochemical test, colonoscopy); methodological details; theoretical framework; predictor variables; and screening outcomes. Screening intention was coded as self-reported, while screening behaviour was coded as either objectively verified (e.g., registry or medical records) or self-reported depending on the data available either in the paper or from study authors. For each study, we coded predictor type, outcome (intention or behaviour), sample size, and effect estimates. Moderator variables (e.g., study design, setting, screening modality) were also recorded. Data extraction was conducted by SS using the standardised form, and a second author (GW) independently coded 10% of eligible articles. Inter-rater agreement was 99%, and any disagreements were resolved through discussion.

4.3.2. Data Analysis

The primary analytic objective was to synthesise effect sizes linking psychosocial predictors to bowel cancer screening outcomes (intention and behaviour). All effect sizes were standardised to a correlation coefficient (*r*). Where studies reported odds ratios (*OR*), values were transformed via log (*OR*) to Cohen's *d* to obtain Pearson's *r* to ensure comparability across predictors. For studies with multiple subgroups or time points, composite effects were calculated with weights proportional to subgroup sample size. Meta-analyses were conducted separately for each predictor–outcome pair (e.g., self-efficacy and behaviour, knowledge and intention), reflecting the thesis objective of identifying the key psychosocial predictors. Analyses distinguished between motivational outcomes (intention) and volitional outcomes (behaviour), consistent with stage-based theoretical frameworks.

Statistical Model. All analyses were conducted in Comprehensive Meta-Analysis (CMA, version 4). Random-effects models with inverse-variance weighting were used, acknowledging expected variability across populations, screening modalities, and measurement approaches. Effect sizes were analysed on the Fisher's z scale and back transformed for presentation. Between-study heterogeneity was quantified with Cochran's Q statistic and the I^2 index. Sensitivity analyses were performed where outlier effects were identified (e.g., for intention-behaviour links). Publication bias was assessed using Egger's regression test in domains with ≥10 studies, with funnel plot inspection to supplement interpretation. This modelling approach ensured comparability across predictors, maximised inclusion of eligible studies, and aligned the analysis with the broader evidence synthesis reported in the Results and Discussion chapters.

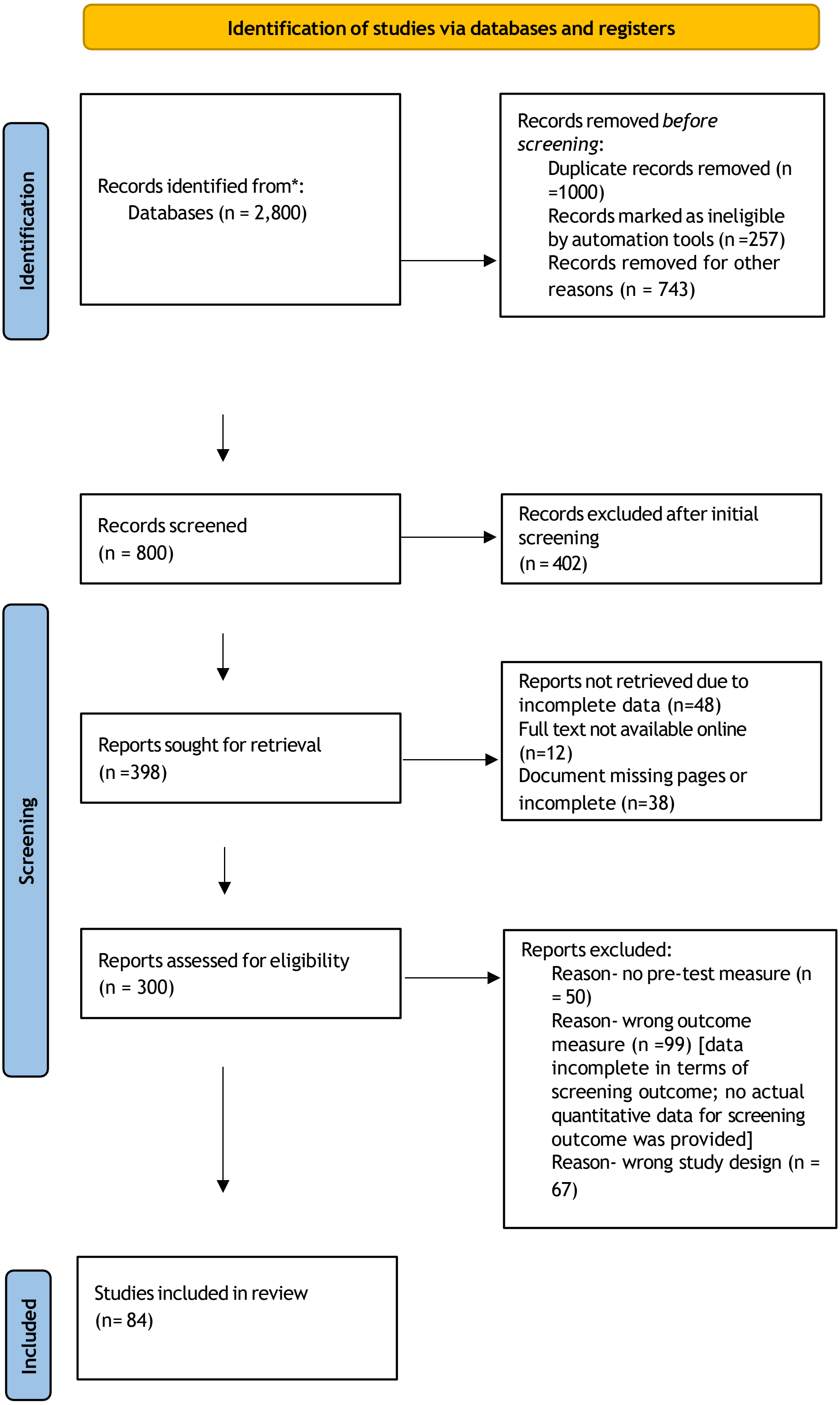
Identification of studies via databases and registers
Identification
Records identified from*:
Databases (n = 2,800)
Records removed *before screening*:
Duplicate records removed (n =1000)
Records marked as ineligible by automation tools (n =257)
Records removed for other reasons (n = 743)
Screening
Records screened
(n = 800)
Records excluded after initial screening
(n = 402)
Reports sought for retrieval
(n =398)
Reports not retrieved due to incomplete data (n=48)
Full text not available online (n=12)
Document missing pages or incomplete (n=38)
Reports assessed for eligibility
(n = 300)
Reports excluded:
Reason- no pre-test measure (n = 50)
Reason- wrong outcome measure (n =99) [data incomplete in terms of screening outcome; no actual quantitative data for screening outcome was provided]
Reason- wrong study design (n = 67)
Included
Studies included in review
(n= 84)

Figure 4.1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only.

4.4. Results

4.4.1 Study Characteristics

Our initial search yielded 2,800 papers and after deduplication we were left with 1,800 original papers. The final dataset comprised of 84 unique studies examining predictors of bowel cancer screening. Studies contributed effect sizes to two outcome categories: behaviour (actual uptake, registry-confirmed or self-reported) and intention to screen (self-reported). By outcome, 52 studies (67.9%) provided at least one effect estimate for behaviour, and 32 studies (40.7%) provided at least one estimate for intention. Seven studies (8.6%) included both behaviour and intention outcomes. When unique samples were aggregated across studies, the model represented 1,636,266 participants. Median per-study sample size was 664 (*IQR* = 405–2,398), indicating substantial variation between small community- or clinic-based studies and very large population-based cohorts. Because outcomes are not mutually exclusive, participant totals by grouping are descriptive rather than additive. Studies contributing behaviour outcomes covered approximately 596,592 participants; those reporting intention outcomes represented 1,067,871 participants; and studies contributing both outcomes accounted for 28,197 participants.

Location reporting was completed for the included studies; studies were included from across countries like the United Kingdom (k =16), the United States (k = 40) and locations spanning across Europe (e.g., Spain, France, Italy)(k = 7), Asia (e.g., Hong Kong/China, South Korea, Saudi Arabia, Malaysia)(k = 8), Australia and New Zealand (k = 4), and sub-national North American settings (e.g., Appalachian regions or specific U.S. states)(k = 9). Reported years ranged from 1980 to 2025.

All study effects were standardised to a common correlation metric (r) to enable comparison. Odds ratios (*ORs*) reported in individual studies were first converted to log (*OR*), then transformed to Cohen’s d and subsequently to r, with correlations stabilised through Fisher’s z transformation. Meta-analyses were then conducted in CMA (Version 4) using random-effects models with inverse-variance weighting, ensuring that larger and more precise studies contributed proportionally more to the pooled effect estimates. Results are reported according to PRISMA 2020 guidelines (Page et al., 2021). Refer to Appendix B. 4.5 for study characteristics details.

4.4.2 Meta-Analysis of the Predictors (See Table 4.4.1 for a quick overview)

Table 4.4.1 Meta-Analysis of the Predictors

Predictor	***Intention (k, r [95% CI], p, I^2, Egger's)***	***Behaviour (k, r [95% CI], p, I^2, Egger's)***	***Overall Interpretation***
Intention	—	*6, .17 [.12, .22], p < .001,* I^2 *= 65.3%, Egger's ns*	Positive, robust predictor of behaviour
Self-Efficacy	*9, .11 [−.01, .22], ns,* I^2 *= 84%, Egger's > .10*	*9, .16 [.08, .24], p < .001,* I^2 *= 83%, Egger's > .10*	Robust for behaviour; weak for intention
Knowledge	*7, .18 [.06, .29], p < .01,* I^2 *= 98.3%, Egger's .87*	*8, .14 [−.04, .31], ns,* I^2 *= 87%, Egger's n/a*	Stronger for intention; weaker for uptake
Perceived Benefits	*6, .18 [.04, .30], p < .05,* I^2 *= 97.6%, Egger's n/a*	*10, .20 [−.10, .47], ns,* I^2 *= 99.9%, Egger's .038*	Motivational predictor; behaviour estimates inflated by bias
Perceived Barriers	*9, −.04 [−.10, .01], ns,* I^2 *= 88.8%, Egger's .97*	*10, −.13 [−.25, .00], p = .05,* I^2 *= 97.1%, Egger's .083*	Stronger negative effect at behaviour stage
Perceived Severity	*7, −.06 [−.20, .08], ns,* I^2 *= 92.3%, Egger's .0013*	*12, .08 [.00, .15], p = .05,* I^2 *= 97.7%, Egger's .54*	Minimal; context-sensitive

Perceived Susceptibility	*9, .09 [−.01, .13], ns, I^2 = 79–99%, Egger’s > .10*	*12, .11 [−.08, .21], ns, I^2 = 97–99%, Egger’s > .10*	Weak; highly variable
Subjective Norms	*3, .15 [.05, .24], p < .01, I^2 = 70.6%, Egger’s ns*	*2, .10 [.00, .19], p ≈ .05, I^2 = 89.1%, Egger’s n/a*	Small, consistent for intention; weaker for behaviour
Age	*3, .26 [−.22, .64], ns, I^2 = 98.7%, Egger’s .26*	*12, .04 [−.01, .08], ns, I^2 = 97%, Egger’s .59*	Minimal and unstable
Ethnicity	*4, .01 [−.24, .26], ns, I^2 = 99.2%, Egger’s n/a*	*3, .19 [−.50, .73], ns, I^2 = 99.8%, Egger’s n/a*	Sparse, highly heterogeneous

Intention and Behaviour Note. *k* = number of studies; *r* = pooled correlation coefficient; *CI* = confidence interval; I^2 = heterogeneity; Egger’s = publication bias test; *ns* = not significant.

Intention

Intention was examined first, given its central role in behavioural models (Ajzen, 1991; Rogers, 1983). Across six studies (7.1% of the dataset), intention was a significant predictor of subsequent screening behaviour ($r = .17$, 95% *CI* [.12, .22], $I^2 = 65.3\%$). The effect is consistent, indicating that stronger intentions increase likelihood of uptake. Overall, the findings align with stage-based accounts of health behaviour: intention opens the door to participation, and strengthening capability and reducing frictions helps people step through it.

Knowledge

Seven studies (8.3%) assessed knowledge–intention associations, yielding a significant pooled correlation ($r = .18$, 95% CI [.06, .29]). Knowledge reliably enhanced motivation to screen. Eight studies (9.5%) examined knowledge–behaviour, producing a non-significant effect ($r = .14$, 95% CI [−.04, .31], $I^2 = 87\%$). Egger's regression was non-significant for both intention ($p = .87$) and behaviour. Knowledge thus appears necessary for intention but insufficient for behaviour.

Perceived Benefits

Six studies (7.1%) examined benefits–intention associations, yielding a significant effect ($r = .18$, 95% CI [.04, .30], $I^2 = 97.6\%$). Ten studies (11.9%) assessed behaviour, producing $r = .20$ (95% CI [−.10, .47]); this effect was positive but imprecise, with evidence of asymmetry (Egger's $p = .038$). Benefits therefore predict motivation consistently but behaviour less reliably.

Self-Efficacy

Nine studies (10.7%) examined self-efficacy–behaviour associations, producing a significant pooled effect ($r = .16$, 95% CI [.08, .24], $I^2 = 83\%$). Nine studies (10.7%) also assessed self-efficacy–intention, yielding a smaller, non-significant effect ($r = .11$, 95% CI [−.01, .22], $I^2 = 84\%$). Egger's tests were non-significant ($ps > .10$). Self-efficacy functions primarily as a volitional determinant, enabling translation of intention into behaviour.

Perceived Barriers

Ten studies (11.9%) assessed barriers–behaviour, producing a negative effect ($r = -.13$, 95% CI [−.25, .00], $I^2 = 97.1\%$). Nine studies (10.7%) tested barriers–intention, yielding a non-significant correlation ($r = -.04$, 95% CI [−.10, .01], $I^2 = 88.8\%$). Egger's regression suggested potential bias for behaviour ($p = .083$) but not intention ($p = .97$). Barriers exert their strongest influence at the volitional stage.

Perceived Susceptibility

Twelve studies (14.3%) assessed susceptibility–behaviour, yielding $r = .11$ (95% CI [−.08, .29], $I^2 = 97–99\%$). Nine studies (10.7%) assessed susceptibility–intention, producing $r = .09$ (95% CI [−.01, .23], $I^2 = 79–99\%$). Egger's regressions were non-significant.

Perceived Severity

Twelve studies (14.3%) examined severity–behaviour, yielding a small positive effect ($r = .08$, 95% *CI* [.00, .15], $I^2 = 97.7\%$). Seven studies (8.3%) assessed severity–intention, producing a small, non-significant negative correlation ($r = −.06$, 95% *CI* [−.20, .08], $I^2 = 92.3\%$). Egger's regression indicated asymmetry for intention ($p = .0013$) but not behaviour ($p = .54$). Severity therefore plays a modest role in behaviour but not intention.

Subjective Norms

Three studies (3.6%) assessed norms–intention associations, producing $r = .15$ (95% *CI* [.05, .24], $I^2 = 70.6\%$). Two studies (2.4%) examined norms–behaviour, yielding $r = .10$ (95% *CI* [.00, .19], $I^2 = 89.1\%$). Norms therefore predict intention modestly, with weaker effects on behaviour.

Demographic Predictors

Age

Twelve studies (14.3%) assessed age–behaviour, yielding a minimal effect ($r = .04$, 95% *CI* [−.01, .08], $I^2 = 97\%$). Three studies (3.6%) assessed age–intention, producing an unstable pooled effect ($r = .26$, 95% *CI* [−.22, .64], $I^2 = 98.7\%$). Overall, age effects were weak and inconsistent.

Ethnicity

Three studies (3.6%) assessed ethnicity–behaviour, yielding a highly imprecise effect ($r = .19$, 95% *CI* [−.50, .73], $I^2 = 99.8\%$). Four studies (4.8%) assessed ethnicity–intention, producing $r = .01$ (95% *CI* [−.24, .26], $I^2 = 99.2\%$). Ethnicity effects were unstable, likely reflecting structural confounding.

Comparative Synthesis

The pattern of associations may suggest a stage-like process consistent with health behaviour theories. At a possible motivational stage, knowledge ($r = .18$; 7 studies, 8.3%) and benefits ($r = .18$; 6 studies, 7.1%) were most reliable. Severity (7–12 studies, 8.3–14.3%), susceptibility (9–12 studies, 10.7–14.3%), and norms (2–3 studies, 2.4–3.6%) were weaker or inconsistent. At a possible volitional stage, self-efficacy ($r = .16$; 9 studies, 10.7%) and barriers ($r = −.13$; 9–10 studies, 10.7–11.9%)

were strongest, with severity contributing a small additional effect (*r* = .08). Intention itself predicted behaviour (*r* = .17; 6 studies, 7.1%), reliably. These findings support PMT's emphasis on coping appraisal and extend HBM predictions by showing benefits and self-efficacy are stronger than severity and susceptibility.

Sensitivity Analysis

A leave-one-out sensitivity test was conducted to evaluate the influence of individual studies on the pooled estimate. The overall pooled odds ratio remained stable, with the leave-one-out range spanning *ORs* = 1.11–11.52. Excluding any single study did not meaningfully alter the direction or statistical significance of the results, indicating that no single data point exerted undue influence. Examination of outlier weights and extreme *log(OR)* values similarly showed minimal effect on the overall outcome, confirming that the findings were robust to both study omission and outlier exclusion.

Heterogeneity and Publication Bias

Heterogeneity was high across most predictors (I^2 often > 90%), reflecting variability in measures and populations. Egger's regression was generally non-significant, with limited evidence of bias except for benefits–behaviour and severity–intention.

4.4.3 Results Summary

Across 84 studies (>1.6 million participants), psychosocial predictors of colorectal cancer screening showed a consistent pattern, although most effects were small to medium in magnitude according to Cohen's (1988) conventions. Knowledge, social norms and perceived benefits consistently enhanced intention. Self-efficacy and reduced barriers most strongly supported uptake, while severity contributed modestly, and susceptibility and demographics showed minimal influence. Intention predicted behaviour overall. Despite higher heterogeneity, the direction of effects was consistent and theoretically coherent, highlighting motivational predictors (knowledge, perceived benefits) and volitional factors (self-efficacy, barrier reduction) as the most reliable predictors of bowel cancer screening behaviour.

4.5. Discussion

4.5.1 Overview

The present meta-analysis synthesised evidence from 84 studies including over 1.6 million participants to identify psychosocial predictors of bowel cancer screening intentions and behaviours. By pooling correlates across diverse settings, time periods, and study designs, the analysis provides one of the most comprehensive quantitative examinations of screening determinants to date. The findings confirm that psychosocial variables exert measurable and modest effects on both motivational outcomes (intention) and volitional outcomes (behaviour). Importantly, the results align with stage-based behavioural models, particularly the Health Belief Model (Rosenstock, 1974) and Protection Motivation Theory (Rogers, 1983), both of which propose that health-protective actions are shaped by appraisals of threat, benefits, and coping capacity.

Consistent with these frameworks, knowledge and perceived benefits emerged as reliable predictors of intention, while self-efficacy and barriers were stronger predictors of behaviour. Severity contributed modestly, susceptibility showed little influence, and demographic correlates (age and ethnicity) were inconsistent once structural factors were considered. The intention–behaviour relationship was positive identifying intention as a consistent predictor of behaviour (Sheeran & Webb, 2016). Taken together, the results confirm that bowel cancer screening participation is governed by a combination of motivational and volitional drivers, with coping appraisal constructs showing particularly strong explanatory power.

4.5.2 Psychosocial Predictors of Bowel Cancer Screening

Across 84 studies comprising more than 1.6 million participants, psychosocial predictors of colorectal cancer screening showed a consistent pattern of associations, with most effects falling within the small to moderate range typical of health behaviour research. Although effect sizes were modest, the consistency of directions across studies indicates a theoretically coherent structure in the predictors of screening intention and behaviour. Overall, motivational constructs such as knowledge, and perceived benefits were more strongly associated with screening intention, whereas volitional constructs such as self-efficacy and perceived barriers were more strongly associated with behaviour, supporting a distinction between motivational readiness and behavioural enactment. These findings align with

Protection Motivation Theory (PMT) and the Health Belief Model (HBM), both of which distinguish between threat appraisal (e.g. perceived severity and susceptibility) and coping appraisal (e.g. self-efficacy, response efficacy, and barriers), suggesting that movement from intention to action depends more on coping resources than on threat perceptions.

Screening Behaviour

Among all predictors examined, intention emerged as one of the most consistent and reliable correlates of screening behaviour ($r = .17$, 95% *CI* [.12, .22]; $k = 6$, $I^2 = 65.3\%$), supporting its central role as a proximal determinant of behaviour in social cognition models (Ajzen, 1991; Sheeran & Webb, 2016). While the magnitude of the intention–behaviour association was modest, this effect is consistent with other meta-analyses in health behaviour where observed effects typically fall below $r = .30$ due to the influence of structural barriers, competing demands, and the intention–behaviour gap (McEachan et al., 2011). In the context of bowel cancer screening, intention may be particularly constrained by volitional challenges linked to the multistep nature of participation (e.g. recognising the kit, collecting samples, returning materials), yet it remained a stronger predictor of uptake than any demographic factor.

Consistent with theoretical expectations, predictors of actual screening behaviour reflected a stronger contribution from volitional processes than from motivational readiness alone. Whereas several psychosocial variables showed reliable associations with intention, a smaller subset demonstrated meaningful links with behavioural uptake, highlighting the importance of factors that facilitate follow-through rather than simply generating motivation. Across studies, behavioural predictors generally showed small but consistent effects, which is expected in population-level screening research where non-psychological barriers (e.g. access, system design, kit usability) also exert influence. The clearest evidence of volitional influence was observed for self-efficacy and perceived barriers, alongside a smaller but notable contribution from perceived benefits and intention. Together, these findings indicate that movement from intention to action depends primarily on coping appraisal, a core assumption of Protection Motivation Theory (Rogers, 1983) and is only modestly influenced by threat appraisal.

Self-efficacy emerged as one of the most consistent behavioural predictors in the synthesis. Across nine studies (11.1% of the dataset), the association between self-efficacy and behaviour was significant (*r* = .16), with moderate-to-high heterogeneity (I^2 = 83%). Individuals who reported confidence in their ability to request, complete, and return screening kits were more likely to participate, suggesting that a sense of personal capability is central to overcoming the procedural demands of the screening process. Unlike several other predictors, self-efficacy showed a stronger relationship with behaviour than intention (*r* = .11), reinforcing its theorised role as a volitional construct. In both PMT and the Health Action Process Approach (HAPA), self-efficacy is conceptualised as essential for translating motivation into action by supporting problem-solving, persistence in the face of obstacles, and recovery from setbacks (Schwarzer, 2008). The present findings align with this position, showing that while self-efficacy may not strongly influence motivational readiness, it is pivotal in ensuring that individuals who intend to screen are able to follow through. These findings are consistent with meta-analyses of PMT more broadly (Floyd et al., 2000; Milne et al., 2000), which consistently identify self-efficacy as one of the strongest predictors of health-protective behaviour. Alongside self-efficacy, perceived barriers (conceptually aligned with response cost in PMT) demonstrated a reliable negative association with behaviour. Across 10 studies (12.3%), barriers were negatively correlated with screening behaviour (*r* = −.13), while their relationship with intention was weaker and non-significant (*r* = −.04; *k* = 9 studies, 11.1%). Reported barriers typically reflected aversion to stool handling, procedural inconvenience, confusion over instructions, and anxiety about receiving results (Myers et al., 1994; Lo et al., 2015; Rawl et al., 2000). These findings suggest that barriers do not strongly deter individuals from forming intentions but instead exert influence at the point of action, disrupting completion even among those motivated to participate. This pattern aligns with HBM, which positions perceived barriers as the most proximal determinant of behaviour (Rosenstock, 1974), and with Carpenter's (2010) meta-analysis, which confirmed barriers as the most consistent negative predictor across health behaviours. Within PMT, barriers map onto response cost, which weakens coping appraisal and reduces protective action despite recognised benefits.

Perceived benefits (aligned with response efficacy in PMT) also contributed to behavioural engagement. Across six studies (7.4%), benefits showed a significant positive association with intention (*r* = .18), and a similar pattern was seen for behaviour (*r* = .20 across 10 studies, 12.3%), although heterogeneity was high (I^2 = 99.9%) and small-study bias was detected. Despite these statistical limitations, the direction of effect was highly consistent across included studies, indicating that individuals who believe screening is effective in detecting cancer early, preventing progression, or providing reassurance are more likely to participate (Wardle et al., 2004). Although benefits are typically regarded as motivational determinants, their impact on behaviour here suggests that strong belief in screening efficacy may help sustain action despite inconvenience or discomfort, acting as a behavioural driver in combination with self-efficacy.

Overall, the behavioural predictors highlight an expected volitional pattern, where screening occurs not simply because individuals endorse its importance but because they have the confidence and support to overcome practical and psychological barriers. This suggests that interventions aiming to improve uptake must move beyond increasing awareness or motivation and instead prioritise action planning, capability-building, and barrier reduction. Evidence-based strategies include procedural guidance, simplified kit instructions, reminder systems, and social support mechanisms, all of which target volitional determinants and directly align with the strongest behavioural predictors identified in this synthesis.

Screening Intention

At the motivational stage of the screening process, predictors that influence individuals’ readiness to participate were primarily cognitive and attitudinal in nature. Knowledge, perceived benefits, and subjective norms were the most consistent correlates of screening intention, collectively reflecting a foundation of informed awareness, positive evaluation, and social endorsement. These constructs represent the motivational phase in both the Health Belief Model (HBM) and Protection Motivation Theory (PMT), where intention forms through appraisals of threat and coping potential before action is initiated. Although effect sizes for these predictors were generally small (*r* = .15–.18), they were consistent and statistically significant across studies, suggesting a robust if modest influence on motivation. Importantly, these variables predicted intention more strongly than behaviour, confirming that knowledge and attitudinal variables are crucial for establishing readiness but are insufficient for ensuring uptake without volitional supports.

Knowledge about bowel cancer and its screening procedures emerged as a reliable predictor of intention but a weaker predictor of behaviour. Across seven studies (8.6% of the dataset), knowledge was positively correlated with intention (r = .18), indicating that individuals with greater understanding of screening's purpose, process, and benefits were more likely to express readiness to participate. However, in eight studies (9.9%), the pooled correlation with behaviour was smaller and non-significant (r = .14), underscoring a dissociation between awareness and action. This mirrors longstanding findings across health behaviour research: knowledge is necessary for informed decision-making but rarely sufficient for behaviour change (Jepson et al., 2010; Weller et al., 2009). In PMT terms, knowledge informs cognitive appraisals, clarifying the severity of disease, potential benefits, and the efficacy of action, but without corresponding self-efficacy or low perceived cost, such information does not automatically translate into screening completion. Theoretical models such as HBM likewise position knowledge as an indirect determinant that supports perceived susceptibility and benefits but is not a primary causal variable. The current synthesis supports this interpretation, showing that while knowledge strengthens motivation, it requires volitional reinforcement for behavioural enactment.

Perceived benefits also played a central role in intention formation. Across six studies (7.4%), benefits showed a significant positive correlation with intention (r = .18), indicating that individuals who recognised the advantages of screening such as early detection, reassurance, and improved survival were more motivated to participate. These findings directly align with HBM predictions, where perceived benefits counterbalance perceived barriers and promote intention to act (Rosenstock, 1974). The theoretical overlap with PMT is clear: perceived benefits correspond to response efficacy, the belief that the recommended action effectively mitigates risk. In this synthesis, benefits were found to predict both intention and, to a lesser extent, behaviour (r = .20 across 10 studies), suggesting continuity between motivational and volitional stages. This dual influence highlights the bridging function of perceived benefits: individuals who believe screening works are more likely to form strong intentions and, under supportive conditions, to act on them. Nonetheless, heterogeneity was high (I^2 = 99.9%), and small-study bias was present, cautioning against overinterpretation of magnitude. Still, the direction and consistency of associations underscore benefits as one of the most robust motivational predictors of screening readiness.

Subjective norms, reflecting perceived social approval or encouragement from significant others, were also associated with stronger screening intentions. Across three studies (3.6%), norms were significantly correlated with intention ($r = .15$, 95% *CI* [.05, .24]), while two studies (2.4%) reported a weaker but positive relationship with behaviour ($r = .10$, 95% *CI* [.00, .19]). Although limited by the small number of studies, this pattern is consistent with the Theory of Planned Behaviour (Ajzen, 1991), which conceptualises social norms as a core determinant of intention. In the context of bowel cancer screening, social and cultural reinforcement through family, peers, or healthcare providers appears to enhance motivation to participate (Jones et al., 2010; Ogedegbe et al., 2005). The weaker behavioural association indicates that normative influence primarily shapes motivation rather than direct enactment, a pattern commonly observed in other health behaviours (Armitage & Conner, 2001). Nevertheless, these findings highlight the social embeddedness of screening decisions and suggest that interventions leveraging trusted relationships may effectively strengthen motivational readiness.

Collectively, the predictors of intention knowledge, perceived benefits, and subjective norms illustrate the motivational foundation of bowel cancer screening. Their combined influence is smaller than volitional predictors but conceptually complementary. While self-efficacy and low barriers enable action, intention reflects the culmination of cognitive and social appraisals that precede behaviour. In practical terms, interventions targeting these constructs by improving public understanding, highlighting screening benefits, and encouraging social support can enhance motivation, which then interacts with volitional determinants to produce behaviour. This pattern reinforces the two-phase model of screening behaviour implied by PMT and HBM: motivation must first be established through informed and socially supported beliefs before volitional self-regulation can take effect.

Threat Appraisal and Background Predictors

Threat-appraisal variables were consistently weaker than coping-appraisal variables in predicting screening outcomes. Perceived severity showed only a modest and statistically fragile association with behaviour ($r = .08$ across 12 studies, 14.8% of the dataset) and no significant association with intention ($r = -.06$ across seven studies, 8.6%). This pattern accords with long-standing critiques that severity, although central in HBM and included in PMT's threat appraisal, has limited predictive power when considered in isolation (Carpenter, 2010). One likely explanation is restricted variance: most people agree that cancer is serious, leaving little individual difference to explain behaviour (Weinstein, 2000). Another is conditionality: severity tends to matter only when coping appraisal is high i.e., when people also believe screening is effective and doable (Floyd et al., 2000; Witte & Allen, 2000).

Perceived susceptibility likewise exhibited negligible associations with both behaviour (*r* = .11 across 12 studies, 14.8%) and intention (*r* = .09 across nine studies, 11.1%), with confidence intervals including zero and substantial heterogeneity. In population screening, where eligibility is defined by age bands rather than personal risk, susceptibility may be less salient than system invitations (Lo et al., 2015). Moreover, optimism bias and cultural norms can mute perceived vulnerability (Robb et al., 2008; Weinstein, 1989). Together, the severity and susceptibility findings reinforce that threat appraisal is a weaker driver than coping appraisal for this behaviour.

Finally, demographic variables were weak and inconsistent direct predictors. Age showed a minimal, non-significant association with behaviour (*r* = .04; *k* = 12) and an unstable link with intention (*r* = .26; *k* = 3), while ethnicity produced near-zero pooled effects for both outcomes given few studies. These patterns are consistent with the view that demographics function as background variables that shape exposure to psychosocial determinants (e.g., barriers, self-efficacy), rather than exerting strong independent effects (Ogedegbe et al., 2005). Overall, the evidence indicates that coping-appraisal constructs not threat or demographic factors primarily account for variance in bowel cancer screening.

Overall Synthesis

Taken together, the findings of this meta-analysis provide a coherent account of the psychological processes underlying bowel cancer screening, consistent with contemporary models of health behaviour. A clear distinction emerged between motivational predictors, which shape intention formation, and volitional predictors, which support behavioural execution. Motivational determinants such as knowledge (*r* = .18), perceived benefits (*r* = .18), and subjective norms (*r* = .15) were reliable but modest correlates of intention, suggesting that individuals typically form screening intentions when they understand the purpose of screening, believe in its benefits, and perceive social approval. However, these predictors did not consistently translate into actual screening behaviour, reflecting the well-established intention–behaviour gap in health psychology (Sheeran & Webb, 2016). By contrast, volitional determinants, particularly self-efficacy (r = .16) and low perceived barriers (r = –.13), were more strongly associated with behaviour, highlighting the importance of personal capability and practical feasibility in enabling screening completion.

The observed pattern lends stronger support to the coping appraisal pathway of Protection Motivation Theory than to its threat appraisal component. Threat-based predictors such as severity (r = .08) and susceptibility (r = .11) had weak or non-significant effects and did not meaningfully influence either intention or behaviour unless paired with coping-related constructs. These findings challenge behaviour change strategies that rely primarily on fear appeals or risk messaging, reinforcing the position that risk awareness alone rarely produces action without enabling conditions (Floyd et al., 2000). The centrality of self-efficacy and response efficacy echoes wider evidence that individuals are more likely to engage in preventive behaviours when they believe they can carry out the behaviour effectively and that the behaviour will achieve meaningful outcomes (Milne et al., 2000).

Demographic predictors such as age and ethnicity showed negligible direct effects and instead appeared to act as background variables, shaping exposure to psychosocial determinants rather than exerting independent influence. This supports the argument that screening inequalities are driven not by demographic characteristics alone but by differential access to psychosocial resources such as knowledge, culturally appropriate communication, and perceived support (Robb et al., 2008). Overall, this synthesis suggests that interventions should adopt a dual focus: building motivation through knowledge and benefit framing and supporting volitional enactment by reducing barriers and strengthening self-efficacy. Strategies such as personalised reminders, step-by-step instructional aids, implementation intentions, and culturally tailored guidance align directly with the most robust predictors identified in this meta-analysis. Together, the findings provide a theoretically grounded explanation of screening behaviour and a clear set of priorities for intervention design.

4.5.3 Theoretical Implications

Taken together, the meta-analytic findings provide a strong test of theoretical frameworks in predicting bowel cancer screening.

Within the Health Belief Model (HBM), intention is not formally specified, but its antecedents are implied through constructs such as benefits, barriers, susceptibility, and severity. In the present synthesis, benefits ($r = .18$; $k = 6$, 7.1%) and barriers ($r = -.13$; $k = 10$, 11.9%) performed as predicted: benefits increased intention, and barriers reduced behaviour. Susceptibility and severity were weak and inconsistent, replicating Carpenter's (2010) observation that these constructs often lack robust predictive power. Self-efficacy ($r = .16$; $k = 9$, 10.7%), added in later HBM formulations, was a reliable behavioural determinant. Overall, coping-related variables (benefits, barriers, self-efficacy) outperformed threat-related variables, while intention emerged as one of the strongest individual predictors of behaviour ($r = .17$; $k = 6$, 7.1%).

Protection Motivation Theory (PMT) offers a clearer framework for interpreting these results. PMT separates threat appraisal (severity, susceptibility) from coping appraisal (response efficacy, self-efficacy, barriers). Consistent with predictions, coping appraisal dominated. Response efficacy (benefits) and self-efficacy were reliable positive correlates, while barriers (costs) consistently suppressed behaviour. Intention, while not explicitly modelled within PMT, can be understood as the motivational endpoint of appraisal. Its reliable correlation with behaviour underscores its central role: individuals who form stronger intentions are significantly more likely to complete screening. This pattern mirrors Floyd et al.'s (2000) and Milne et al.'s (2000) conclusions that coping appraisal and motivational commitment jointly drive adaptive behaviour.

Subjective norms also add to the theoretical picture. Although not part of HBM or PMT, they are central to the Theory of Planned Behaviour (Ajzen, 1991). In this synthesis, norms predicted intention significantly ($r = .15$; $k = 3$, 3.6%) and behaviour weakly ($r = .10$; $k = 2$, 2.4%). Normative support therefore appears to shape motivation, particularly in contexts where family or community endorsement is influential (Ogedegbe et al., 2005; Rivis & Sheeran, 2003). Together, intention, coping appraisal, and social norms form a coherent explanatory account: intention is the strongest single predictor of screening, but its successful enactment is bolstered by coping resources and normative encouragement.

Finally, demographic variables such as age and ethnicity played only weak direct roles. In HBM, demographics are distal influences on beliefs, while in PMT they shape appraisal processes and resources. Their indirect effects through psychosocial pathways remain important, but their weak direct associations here are consistent with theoretical expectations.

4.5.4 Implications for Intervention Design

The central role of intention in this synthesis underscores the importance of strengthening motivation as a foundation for behaviour change. Intention was one of the strongest predictors of bowel cancer screening uptake (r = .17; k = 6, 7.1%), outperforming most other psychosocial variables. Interventions should therefore prioritise strategies that reliably enhance intention, such as increasing knowledge, emphasising screening benefits, and leveraging normative influence. These elements can build strong motivational commitment, which is a prerequisite for uptake.

At the same time, volitional supports are critical to ensuring intentions translate into action. Enhancing self-efficacy through skills training, clear kit instructions, and “if–then” planning can equip individuals to overcome procedural and emotional barriers (Orbell & Sheeran, 2000). Reducing logistical and affective barriers, such as embarrassment, disgust, or confusion, through reminders, simplified procedures, and culturally tailored communication further strengthens the intention–behaviour pathway (Lo et al., 2015). Incorporating normative influence, particularly through trusted figures such as general practitioners, family members, or community leaders, may also amplify motivation and sustain follow-through (Ogedegbe et al., 2005; Rivis & Sheeran, 2003).

Together, these findings suggest that the most effective interventions will combine motivational enhancers (e.g., intention, knowledge, benefits, norms) with volitional facilitators (e.g., self-efficacy, reduced barriers). Such integrated approaches are most likely to convert strong intentions into consistent bowel cancer screening behaviour.

4.5.5 Practical Implications, Study Strengths and Limitations

Practical Implications. The present findings carry important implications for designing interventions and public health strategies to increase bowel cancer screening uptake. A clear conclusion is that interventions should target both intention formation and coping appraisal constructs. Intention emerged as one of the strongest individual predictors of screening behaviour (r = .17; k = 6, 7.1%), confirming its central role as a motivational prerequisite. Coping appraisal variables such as self-efficacy, benefits (response efficacy), and reduced barriers were equally critical in ensuring that intentions translated into action.

At the individual level, interventions can employ behaviour change techniques that strengthen both intention and volition. Action planning and implementation intentions (e.g., “If I receive the kit, then I will complete it the same evening”) have been shown to bridge the intention–behaviour gap (Orbell & Sheeran, 2000; Sheeran & Webb, 2016). Skills training, demonstrations, and peer modelling may further enhance confidence, while reinforcing the benefits of screening sustains motivation. At the community level, subjective norms and cultural tailoring are key. Norms predicted intention reliably (r = .15; k = 3, 3.6%), suggesting that social endorsement strengthens motivation. Information campaigns that use trusted community leaders, provide language-appropriate materials, and address cultural norms can reduce disparities (Jandorf et al., 2005; Ogedegbe et al., 2005). Such strategies operate by both increasing intention and lowering perceived barriers.

At the system level, structural supports are essential to maintain follow-through. Simplified kit design, prepaid return envelopes, and reminder systems can minimise attrition, while endorsements from primary care providers have consistently increased uptake by reinforcing both intention and response efficacy (Wardle et al., 2004). Policymakers should therefore prioritise multi-level strategies that combine intention-strengthening components with structural and volitional supports, creating an enabling environment for sustained screening participation.

Strengths and limitations. A key strength of this meta-analysis lies in its breadth and inclusivity. By synthesising 84 studies across diverse countries, time periods, and populations, the analysis provides a uniquely comprehensive evidence base on psychosocial predictors of bowel cancer screening. The inclusion of over 1.6 million participants enhances generalisability and ensures that both small community studies and large population cohorts are represented. Another strength is the rigorous analytic approach. All effect sizes were standardised to a common correlation metric (*r*), with odds ratios systematically transformed to allow comparability. Random-effects models were employed to account for between-study variability, reflecting the diverse contexts of bowel cancer screening.

Several limitations should be acknowledged. First, heterogeneity was extremely high across most analyses (I^2 often > 95%). While expected given the diversity of measures, populations, and contexts, this reduces confidence in pooled estimates. Effect sizes should therefore be interpreted as average tendencies rather than precise parameters. Many included studies were cross-sectional, making it difficult to infer causal direction. Finally, measurement inconsistency across studies, ranging from single items to validated scales, may have contributed to heterogeneity. Constructs such as barriers varied widely in operationalisation, from logistical concerns to emotional discomfort, complicating synthesis.

4.5.5 Conclusion

This systematic review provides a comprehensive synthesis of psychosocial predictors of bowel cancer screening intention and behaviour. The findings demonstrate a consistent pattern: intention emerged as one of the strongest individual predictors of behaviour ($r = .17$; $k = 6$, 7.1%), underscoring its central role as a motivational precursor. Knowledge ($r = .18$; $k = 7$, 8.3%) and perceived benefits ($r = .18$; $k = 6$, 7.1%) reliably promoted intention, while self-efficacy ($r = .16$; $k = 9$, 10.7%) and reduced barriers ($r = −.13$; $k = 10$, 11.9%) facilitated translation into behaviour. Severity contributed modestly to prioritisation, susceptibility played little role, and demographic factors, while weak direct predictors, functioned as background variables shaping psychosocial determinants.

The theoretical pattern strongly supports Protection Motivation Theory and the Health Belief Model, with coping appraisal constructs (self-efficacy, benefits, barriers) and intention consistently outperforming threat appraisal (severity, susceptibility). From a policy perspective, interventions should emphasise strengthening intention alongside enhancing self-efficacy and minimising barriers, supported by strategies that highlight screening benefits and improve knowledge. Tailoring to culturally diverse groups and embedding system-level supports will be essential for equity. By aligning strategies with the empirically strongest predictors, particularly intention, public health efforts can more effectively increase participation in bowel cancer screening and reduce preventable mortality.

4.6. Chapter Summary

Chapter 4 synthesised the international quantitative evidence on predictors of bowel cancer screening intention and behaviour, providing a comprehensive and systematic assessment of psychosocial and demographic determinants. Building on Chapter 3's qualitative exploration of barriers and facilitators, this chapter identified which variables consistently predict screening outcomes, quantified their relative strength, and situated them within dominant theoretical frameworks such as the Health Belief Model (Rosenstock, 1974) and Protection Motivation Theory (Rogers, 1983).

The evidence base encompassed 84 independent studies conducted across diverse countries, populations, and screening modalities. By converting heterogeneous effect size metrics into a common correlation coefficient, the meta-analysis enabled direct comparison across predictors and outcomes. This methodological decision ensured consistency and comparability, allowing clear conclusions about which factors most reliably predict screening uptake and intention, and highlighting the relative influence of motivational versus volitional constructs.

One of the clearest findings was the role of intention as a strong predictor of behaviour. Across six studies, representing 7.1% of the dataset, intention showed a significant pooled correlation with screening uptake ($r = .17$, 95% *CI* [.12, .22]), with moderate heterogeneity ($I^2 = 65.3\%$). Although smaller than the average correlation of $r = .30$ reported across health behaviours (McEachan et al., 2011; Sheeran & Webb, 2016), this effect establishes intention as one of the most reliable psychosocial predictors in this domain. The result underscores the centrality of intention as a motivational precursor: individuals who expressed stronger readiness to screen were consistently more likely to follow through, despite the multi-step and sometimes aversive nature of the screening process. This conclusion resonates with Chapter 3, where participants frequently described "wanting" or "planning" to screen but identified barriers that interrupted follow-through.

Consistent with PMT predictions, coping appraisal constructs emerged as the most decisive determinants of behaviour. Self-efficacy ($r = .16$; $k = 9$, 10.7%) was a robust positive predictor of uptake, with individuals confident in their ability to request, complete, and return screening kits significantly more likely to participate. Importantly, self-efficacy effects were stronger for behaviour than for intention, confirming its role as a volitional determinant at the enactment stage. Perceived barriers ($r = -.13$; $k = 10$, 11.9%) were equally consistent, exerting a negative influence on behaviour. Barriers such as embarrassment, disgust, logistical challenges, or lack of time undermined uptake more than they weakened motivation. This finding dovetails with the qualitative results in Chapter 3, where participants frequently identified stool handling, procedural confusion, and competing priorities as obstacles that derailed intentions. Perceived benefits ($r = .18$; $k = 6$, 7.1%), representing response efficacy, were reliable motivational predictors. Endorsements of screening's advantages such as reassurance, early detection, and peace of mind were strongly associated with intention and, to a lesser degree, behaviour. Together, these findings demonstrate that coping appraisal constructs like self-efficacy, benefits, and barriers were the most consistent predictors, both statistically and conceptually, confirming PMT's emphasis on coping rather than threat appraisal.

By contrast, threat appraisal variables were weaker and inconsistent. Perceived severity was modestly associated with behaviour (r = .08; k = 12, 14.3%), but its effect on intention was small and non-significant. Perceived susceptibility was similarly weak (r = .09–.11; k = 9–12, 10.7–14.3%). These results echo previous critiques (Carpenter, 2010) and suggest that while risk perceptions may raise awareness, they are insufficient to generate strong motivation or follow-through in the absence of coping resources.

Other psychosocial constructs also contributed meaningfully, albeit with smaller effect sizes. Knowledge ($r = .18$ for intention, $k = 7$, 8.3%; $r = .14$ for behaviour, $k = 8$, 9.5%) consistently increased motivation, though its impact on actual uptake was weaker. This pattern supports evidence that awareness interventions raise readiness but do not guarantee action without accompanying volitional supports (Jepson et al., 2010; Weller et al., 2009). Subjective norms, although examined less frequently, also emerged as relevant. Norms predicted intention reliably ($r = .15$; $k = 3$, 3.6%) and behaviour weakly ($r = .10$; $k = 2$, 2.4%). These findings highlight the role of social encouragement from family, peers, and healthcare providers in fostering motivation, consistent with the Theory of Planned Behaviour (Ajzen, 1991; Rivis & Sheeran, 2003). Norms thus function as supporting motivational influences, particularly in cultural contexts where family and community endorsement are salient.

Demographic variables exerted weaker and less consistent effects overall. Age was minimally associated with behaviour (*r* = .04; *k* = 12, 14.3%), and intention effects were unstable (*r* = .26, *k* = 3, 3.6%). Ethnicity showed highly heterogeneous effects (*r* = .01 for intention; r = .19 for behaviour; *k* = 3–4, 3.6–4.8%), reflecting inconsistent measurement and the confounding influence of socioeconomic and structural variables. Chapter 3 highlighted similar themes, with participants from minority ethnic backgrounds describing cultural stigma, lack of tailored information, and mistrust of health systems as barriers. These findings suggest that while demographic variables are weak predictors in isolation, they exert indirect effects through psychosocial and structural pathways. In this respect, demographic disparities may be better understood as contextual influences shaping exposure to and interaction with psychosocial predictors, rather than as direct determinants of screening behaviour.

The integration of these quantitative findings with earlier chapters strengthens the overall thesis narrative. Chapter 1 introduced the public health importance of bowel cancer screening and theoretical frameworks such as HBM and PMT. Chapter 2 established methodological foundations for systematic evidence synthesis. Chapter 3 generated qualitative insights into barriers and facilitators, highlighting lived experiences of embarrassment, logistical burden, and the importance of confidence. Chapter 4 quantified these themes across 84 studies, demonstrating empirically that coping appraisal constructs (self-efficacy, benefits, barriers) and intention are the strongest predictors, while threat appraisal and demographics are weaker. In doing so, this chapter consolidated evidence from diverse contexts and confirmed the theoretical frameworks outlined in the introduction.

Crucially, the findings from Chapter 4 set the stage for Chapter 5. While Chapter 4 drew on international evidence, Chapter 5 applies these insights to new empirical data from UK and Indian populations. Guided by the review’s conclusions, Chapter 5 focuses on the strongest predictors such as intention, self-efficacy, response efficacy, barriers, knowledge, severity, and susceptibility, while also explicitly testing demographic moderators such as age, education, ethnicity, and country of origin. In doing so, Chapter 5 addresses key gaps identified here: the need to assess predictors across cultural contexts and to examine whether the balance between motivational (intention, benefits, knowledge, norms) and volitional (self-efficacy, barriers) constructs holds consistently across countries.

In summary, Chapter 4 demonstrates that psychosocial predictors of bowel cancer screening intention and behaviour are both theoretically grounded and empirically robust. Intention, coping appraisal constructs, and subjective norms were the most reliable predictors, while knowledge contributed meaningfully to motivation but less so to behaviour. Threat appraisal constructs and demographics were weaker and highly context dependent. These results echo and extend Chapter 3’s qualitative themes, showing that confidence, practical support, and social endorsement are decisive for uptake. By clarifying which predictors are robust and which vary by context, this chapter provides the empirical rationale for the cross-cultural analysis in Chapter 5, ensuring that the next stage of the thesis is firmly anchored in both theory and evidence.

Chapter 5

Examining Predictors of Bowel Cancer Screening Intention: A Cross-Cultural comparison of Protection Motivation Theory Constructs

5.1 Chapter Overview

Chapter 3 provided a qualitative exploration of the barriers and facilitators influencing bowel cancer screening, highlighting how psychological, social, and cultural factors such as perceived severity, perceived susceptibility, knowledge and self-efficacy shape participation. These findings pointed to important differences across contexts particularly between White British, UK-Asian, and Indian groups but did not establish which specific psychosocial or demographic factors consistently predict intention. Chapter 4 addressed this gap through a systematic review and meta-analysis of international evidence, showing how intention is a strong predictor of screening behaviour as well as highlighting how PMT constructs are the most reliable predictors of screening intention, with knowledge, self-efficacy and perceived barriers emerging as the strongest correlates of screening intention. However, substantial cross-cultural variation was also evident, underscoring the importance of testing these predictors within different populations.

The present chapter builds directly on these insights by operationalising both psychosocial and demographic variables in large samples from the UK and India. Specifically, PMT constructs (self-efficacy, response efficacy, response cost, perceived severity, and perceived vulnerability) plus knowledge are examined as correlates of screening intention, alongside demographic predictors (education, ethnicity, age, gender, country, and prior screening history). The analytical strategy is structured to first establish the contribution of PMT predictors after controlling for demographics, then test whether these associations differ across countries, and finally to probe subgroup contrasts (India vs. UK-Asian vs. UK-Non-Asian) and also assesses moderation by age, gender, screening history and education. This allows for a systematic evaluation of the key predictors and moderators.

Accordingly, this chapter aims to:

1. Identify the key psychosocial predictors of bowel cancer screening intention, grounded in PMT.

2. Test whether these predictors differ across countries (UK vs. India) and across subgroups (India, UK-Asian, UK-Non-Asian).
3. Evaluate whether demographic variables (age, gender, education, ethnicity, country, and screening history) independently predict intention and moderate the effects of psychosocial variables.
4. Provide empirical evidence to inform culturally tailored interventions aimed at strengthening self-efficacy, reducing barriers, and addressing contextual differences in screening motivation.

5.2 Introduction

5.2.1 Background

Bowel cancer remains one of the leading causes of cancer mortality worldwide and is expected to pose a continuing public health challenge in the coming decades (Cancer Research UK, 2025). Screening programmes substantially reduce mortality by enabling early detection (Hewitson et al., 2008; Njor et al., 2012), yet participation rates remain below recommended levels and show marked social and cultural variation (Quaife et al., 2022). Understanding what drives screening intention is therefore critical, as intention is consistently identified as the most proximal determinant of behaviour in social cognition models (Ajzen, 1991; Sheeran & Webb, 2016). Meta-analytic reviews of the Theory of Planned Behaviour (TPB) demonstrate medium-to-large average correlations between intention and behaviour across health domains (mean $r = .45$; Sheeran, 2002), but smaller effects in cancer screening specifically ($r = .20–.25$; Cooke & French, 2008). More recent syntheses confirm this attenuation, highlighting how contextual and structural barriers constrain the translation of intention into action in the screening context (Conner & Norman, 2026). These findings underscore the importance of systematically examining which psychosocial constructs reliably predict both screening intention and uptake.

Social cognition models, particularly Protection Motivation Theory (PMT), provide a strong framework for examining screening decisions. PMT emphasises two parallel appraisal processes: threat appraisal, which considers perceived severity and vulnerability, and coping appraisal, which weighs self-efficacy, response efficacy, and response costs (Norman, Boer, & Seydel, 2005; Rogers, 1983). Meta-analytic evidence indicates that coping appraisal variables are the most reliable predictors of cancer screening outcomes. For example, Sheeran et al. (2014) reported that self-efficacy showed a medium-sized association with screening intention (r = .30) and behaviour (r = .25), while response costs (barriers) were robust negative predictors (mean r = –.25). By contrast, threat appraisal constructs such as perceived severity and vulnerability typically demonstrated weaker and more context-dependent effects, often below r = .10 (Conner & Norman, 2026; Sheeran & Webb, 2016). Collectively, this evidence underscores the centrality of coping appraisal variables in predicting both intention and uptake of screening behaviour. Knowledge has also emerged as an important correlate, often reinforcing efficacy beliefs and reducing perceived barriers (von Wagner et al., 2009). However, the strength and consistency of these associations vary across cultural and demographic groups, underscoring the need for further investigation.

Cross-cultural comparisons are particularly valuable in clarifying how predictors of intention operate across different healthcare contexts. In high-income countries such as the UK, uptake is patterned by social inequalities, with lower participation among ethnic minority and socioeconomically disadvantaged groups (Quaife et al., 2022; Waller et al., 2009). In contrast, in lower- and middle-income settings such as India, screening programmes are less established and public awareness remains limited (Rawla et al., 2019; Sathian et al., 2014). These contextual differences may shape the weight of PMT constructs: for example, knowledge and vulnerability may drive intention more strongly where structured programmes exist, whereas perceived barriers may dominate in lower-resource contexts. Prior research highlights lower uptake among minority ethnic groups, those with lower educational attainment, and individuals reporting greater psychological or practical barriers (Hirst et al., 2018; Kerrison et al., 2019). Clarifying these differences can determine whether predictors identified in high-income settings generalise cross-culturally or require adaptation. Focusing specifically on the UK and India therefore provides a meaningful contrast between a setting with mature screening infrastructure and persistent inequalities, and one where programmes are emergent, and public awareness remains low (Gupta et al., 2017). This comparison also allows exploration of whether key predictors operate similarly across these contexts and within important demographic subgroups such as age, gender, and education that are consistently implicated in screening disparities (von Wagner et al., 2011).

In addition to cultural variation, demographic factors such as age, gender, education, screening history and ethnicity influence screening motivation, though their effects are often inconsistent. Yet the mechanisms through which these demographics interact with cognitive predictors remain underexplored. It would therefore be valuable to explore the potential moderating role of demographic variables on PMT processes.

In summary, identifying the psychosocial and demographic predictors of bowel cancer screening intention is essential for advancing theory and making recommendations for interventions to improve screening uptake. Evidence consistently highlights self-efficacy, response efficacy, and barriers as central determinants, but their relative influence varies across cultural and demographic contexts. By directly comparing UK and Indian participants and examining subgroup differences, the present study addresses these gaps, providing insight into both universal and context-dependent predictors of intention.

5.2.2 Theoretical Framework

Protection Motivation Theory (PMT) was developed to explain why individuals adopt health-protective behaviours, emphasising the cognitive processes underlying decisions to engage or not engage in recommended actions (Rogers, 1975). Unlike other health models such as the Theory of Reasoned Action (Ajzen & Fishbein, 1980) and the Health Belief Model (Janz & Becker, 1984), PMT distinguishes between two complementary appraisal pathways (as displayed in Figure 5.1): threat appraisal, which evaluates perceived severity and vulnerability, and coping appraisal, which assesses self-efficacy, response efficacy, and response costs (Prentice-Dunn & Rogers, 1986). This structure provides a more comprehensive account of how individuals balance perceptions of risk against beliefs in their ability to act and the anticipated benefits or barriers of action.

Meta-analytic evidence consistently shows that coping appraisal constructs particularly self-efficacy and barriers are the strongest predictors of intention and behaviour across cancer screening contexts (Sheeran et al., 2014). Response efficacy also plays a substantial role, as beliefs in the effectiveness of screening can motivate individuals to overcome perceived inconvenience or discomfort (Lo et al., 2015). By contrast, threat appraisal constructs such as severity and vulnerability are generally weaker or more context dependent (Ferrer & Klein, 2015). Knowledge, while not a core PMT construct, is increasingly recognised as a foundation for both threat and coping appraisals, reinforcing efficacy beliefs and reducing misconceptions that contribute to perceived barriers (Miles et al., 2011; von Wagner et al., 2009).

In addition to psychological factors, PMT can accommodate the influence of sociodemographic variables by recognising that appraisals are shaped by context. For instance, limited socioeconomic resources may heighten perceived barriers and undermine self-efficacy, while cultural stigma may alter beliefs about effectiveness and vulnerability (Orbell, Johnston, & Crombie, 1996; Whitaker et al., 2011). Empirical evidence also shows that sociodemographic differences such as ethnicity, education, and country of residence interact with PMT predictors, producing systematic variation in motivational pathways (Vrinten et al., 2017). To understand screening behaviour, PMT provides a theoretically coherent basis for integrating psychosocial and demographic influences on screening intention.

The decision to apply PMT in the present study was directly informed by the earlier chapters of this thesis. Chapter 3 highlighted, through qualitative accounts, how barriers such as low self-efficacy, perceived severity, lack of screening knowledge, and cultural orientation towards preventive healthcare shape attitudes to screening in both the UK and India. Chapter 4, through systematic review and meta-analysis, showed that self-efficacy and perceived barriers consistently emerged as the strongest predictors across quantitative studies, while knowledge, severity, and vulnerability had more variable effects. Taken together, these findings pointed to the central importance of coping appraisal and the need to test whether these processes operate similarly across cultural contexts. By applying PMT to a cross-cultural sample, this study therefore aimed to empirically assess the relative strength of coping and threat appraisal constructs, the additional role of knowledge, and the extent to which demographic and cultural context moderate these relationships. PMT provides the theoretical lens through which both universal predictors and context-specific variations can be identified, thereby offering insights with direct relevance for tailoring interventions to improve bowel cancer screening uptake.

Although Protection Motivation Theory includes additional constructs such as intrinsic rewards (e.g., personal satisfaction from not engaging in the behaviour) and extrinsic rewards (e.g., social approval for avoidance), these were not measured in the present study. This decision reflects both theoretical and empirical considerations. First, intrinsic and extrinsic rewards are typically more relevant to behaviours with perceived short-term positive consequences, such as smoking or unhealthy eating (Milne et al., 2000; Rogers, 1983) and are less applicable to preventive health behaviours like cancer screening, where avoidance offers no tangible reward (Boer & Seydel, 1996). Second, systematic reviews in cancer screening contexts show that reward constructs rarely predict screening intentions and are often omitted without reducing model validity (Sheeran et al., 2014). Finally, to reduce participant burden and maintain construct clarity, priority was given to established PMT predictors in cancer screening i.e. self-efficacy, response efficacy, perceived vulnerability, perceived severity, and response cost alongside knowledge. Therefore, excluding reward variables is consistent with both prior PMT applications in screening and empirical evidence of predictor relevance. Figure 5.1 displays the basic structure of the model.

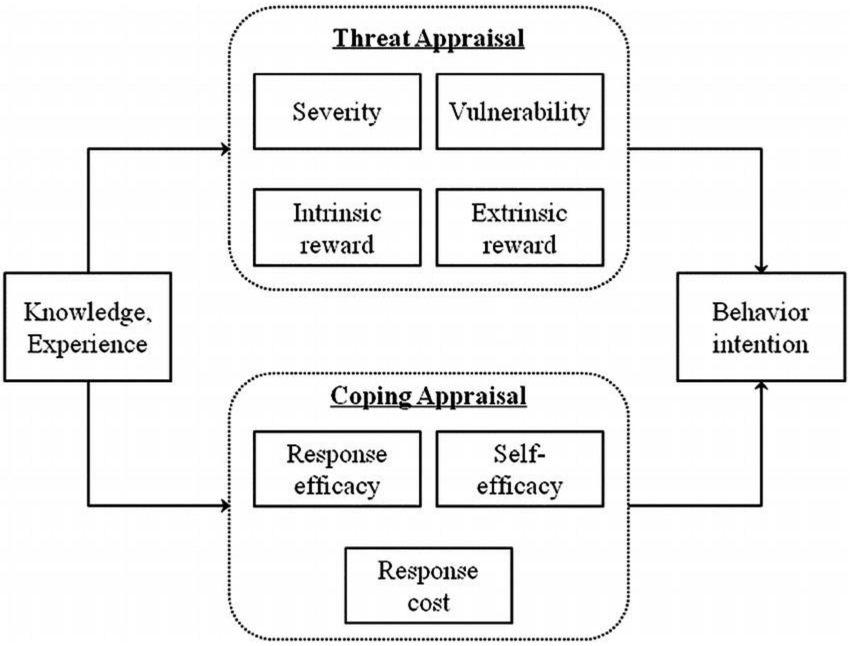

Figure 5.1 PMT Model

In summary, bowel cancer screening is an effective preventive strategy, but uptake remains suboptimal and socially patterned. Prior research has established that coping appraisal factors, particularly self-efficacy, response efficacy, and perceived barriers, are central to screening motivation, while the influence of threat appraisal and knowledge varies across contexts. However, the extent to which these predictors operate consistently across cultural settings and demographic groups remains unclear.

The objects of this study are therefore to:

1. Identify the key psychosocial predictors of bowel cancer screening intention using the Protection Motivation Theory framework.
2. Compare the relative influence of coping versus threat appraisal constructs, with knowledge assessed as an additional predictor.
3. Evaluate cross-cultural differences in predictor strength between UK and Indian participants, and within the UK between Asian and non-Asian groups.
4. Test the moderating role of demographic factors (age, gender, education, ethnicity, and prior screening history) on the relationships between PMT constructs and screening intention.

Hence, within this chapter, we test whether PMT predictors explain screening intentions across the UK and India, and whether demographic factors particularly ethnicity and education moderate these relationships.

5.3 Methods

5.3.1 Design

This study used a cross-sectional survey design to examine sociodemographic and psychological predictors of bowel cancer screening intention. Guided by Protection Motivation Theory (PMT), the study compared UK and Indian participants to test both direct effects and examine cultural differences.

5.3.2 Participant Recruitment

Clear inclusion and exclusion criteria were established prior to recruitment. Eligible participants were aged 50 years or older (consistent with bowel cancer screening guidelines), able to read and understand English study materials, and capable of providing informed consent. As the study was conducted online, participants were also required to have internet access. Individuals were excluded if they did not provide informed consent. Recruitment was conducted through academic crowdsourcing platforms Prolific and BeSample, which are widely used in behavioural and health sciences for accessing large, diverse, and pre-screened participant pools (Palan & Schitter, 2018). These platforms maintain extensive demographic databases, allowing researchers to target participants based on specified inclusion criteria (e.g., age, gender, country of residence, ethnicity, SES). Participants could only complete the survey once and were compensated at a standardised rate of £2.50 per 10 minutes.

Using online platforms ensured efficient and transparent recruitment while facilitating representation of key subgroups (e.g., low- and high-SES, ethnic minority groups). This was essential given the study's aim to examine how sociodemographic and psychosocial factors shape screening intention across culturally distinct populations. By applying identical eligibility criteria and recruitment procedures in the UK and India, the study strengthened the validity of cross-cultural comparisons. In addition to broad reach, crowdsourcing offered practical advantages over community or clinic-based sampling, including reduced logistical burden, lower cost, and faster data collection, while maintaining high ethical and data quality standards (Palan & Schitter, 2018). This approach was therefore well suited to the scope and design of the present study.

5.3.3 Survey Measures and Scale Development

Several factors were considered while designing a survey that examines predictors of bowel cancer screening intention across different groups. A comprehensive literature review (Chapter 4) and 30 qualitative interviews (Chapter 3) were conducted, which contributed to the identification of the psychological scales and measures used in the present study. As indicated earlier the development of the questionnaire incorporated items from PMT framework, the questionnaire also included other factors that were considered pertinent to achieving a conceptual understanding of screening intention (e.g., sociodemographic factors). Item selection was guided by the findings of the preceding studies ensuring that constructs identified as salient across both literatures were operationalised quantitatively. Established measures from prior screening and health psychology research were adapted where possible to enhance validity and comparability (e.g., items adapted from Orbell et al., 1996).

Constructs were grouped into multi-item scales representing factors like perceived severity, perceived vulnerability, self-efficacy, response efficacy and perceived barriers. Each item was rated on a 6-point Likert scale, allowing the computation of composite scores for each construct. Additionally, intention items were designed to assess the likelihood of completing a bowel cancer screening test if offered, consistent with prior behavioural intention research. Items were added to test factors like knowledge as well as to include sociodemographic information. This structured development process ensured that the final survey captured both theoretically grounded PMT constructs and contextually relevant concerns about bowel cancer screening.

Constructs

The questionnaire (enclosed within Appendix C 5.1 and Participant Information Sheet is enclosed within 5.2) included items to assess a range of sociodemographic factors including age, gender, education, country of origin, location and ethnic background. Participants were asked to self-report whether they had completed a bowel cancer test before to gage their history with bowel cancer screening. Internal consistency was assessed for all the constructs. Self-efficacy showed good internal consistency ($\alpha = .73$), as did knowledge ($\alpha = .77$) and intention ($\alpha = .69$). Perceived severity was also displayed good consistency ($\alpha = .70$), while perceived vulnerability was slightly lower ($\alpha = .64$) but still within a good range for short scales. Response efficacy performed well ($\alpha = .66$). Response costs scale displayed an internal consistency of $\alpha = .74$, indicating good reliability. These results suggest that the key constructs demonstrate strong internal consistency, supporting the use of their composite mean scores in further analyses.

Knowledge

Bowel Cancer Screening knowledge was measured in the first section of the survey, the items within this section assessed knowledge of bowel cancer screening tests and knowledge of risk factors that are associated with not getting screened regularly. The development of these knowledge items was informed by previous research in the cancer screening literature (Miles et al, 2008; Low et al, 2013; Von Wagner, 2011). Knowledge was assessed via 3 items developed for this survey, questions included items like ‘Doing a bowel cancer screening test in the future helps with early detection and reduces mortality by improving treatment outcomes' 'Doing a bowel cancer screening test in the future can help find bowel cancer early, even if you have no symptoms' and 'Doing a bowel cancer screening test in the future is only important for people with a family history of bowel cancer'. Participants then had to choose between True or False to reflect their opinions on each statement. Studies have consistently shown that individuals' understanding of cancer and its prevention influences their likelihood of engaging in protective health behaviours. In bowel cancer specifically, knowledge about the purpose and benefits of screening has been identified as a determinant of intention and uptake. Guided by this evidence, the knowledge scale in the present study was designed to capture both awareness of bowel cancer risk and understanding of the role of screening in early detection, thereby ensuring alignment with established literature and theoretical frameworks. Knowledge is not a core PMT construct but has been integrated into both threat and coping appraisals in extensions of the model (Prentice-Dunn & Rogers, 1986). Knowledge provides the informational foundation for evaluating severity, vulnerability, and coping strategies. Empirical evidence consistently points to the importance of knowledge in cancer screening (McCaffery et al., 2003; Whitaker et al., 2011). Knowledge also plays a key role in informed choice and has been identified as a mediator of socioeconomic inequalities in screening participation. For these reasons, knowledge items were developed for this study.

Intention

Intention was the outcome variable within this study. Intention here refers to the intention to complete a bowel cancer screening test in the future. Three items explored people's intention to get screened, these included items like 'I intend to do a bowel cancer screening test in the future' 'I want to do a bowel cancer screening test in the future' 'I expect to do a bowel cancer screening test in the future'. Participants indicated their intention to get screened along a 6-point Likert scale. This measure had been developed using references from previous literature that had been found to have good internal consistency (Orbell et al., 2017; Schifter & Ajzen, 1985).

Response Efficacy

Response efficacy was measured along a 6-point Likert scale consisting of 8 items. Items included within this scale included questions like ‘Doing a bowel cancer screening test in the future would reduce my chances of dying from bowel cancer’, ’Doing a bowel cancer screening test in the future would help find any abnormalities’, ‘Doing a bowel cancer screening test in the future would increase my chances of getting treatment earlier’, ‘Doing a bowel cancer screening test in the future would help me avoid having to have drastic treatment’, ‘Doing a bowel cancer screening test in the future would put my mind at rest about bowel cancer’, ‘Doing a bowel cancer screening test in the future would reduce any worries I might have about getting bowel cancer’, ‘Doing a bowel cancer screening test in the future would increase my confidence about not getting bowel cancer’ and ‘Doing a bowel cancer screening test in the future would reduce any worries I might have about having other abnormalities’(adapted from Orbell et al., 2017) higher scores denoted greater response efficacy.

Self-efficacy

Self-efficacy is a central component of coping appraisal in PMT and has consistently been identified as one of the strongest predictors of health-protective behaviour (Bandura, 1997; Rogers, 1983). In Bowel Cancer screening, self-efficacy has been repeatedly shown to be a robust correlate of intention and behaviour (Katapodi et al., 2004; McQueen et al., 2008). Interventions that increase self-efficacy are often effective at improving screening uptake. Given this strong empirical grounding, self-efficacy was hypothesised to emerge as a strong predictor of bowel cancer screening intention in both UK and Indian samples. This construct was measured along a 6-point Likert scale. Self-efficacy was assessed with three items. These included: ‘If I am invited to do a bowel cancer screening test in the future, I am certain that I could do it’ and ‘If I am invited to do a bowel cancer screening test in the future, I would feel very confident in my ability to do it’. A reverse-coded item was ‘If I am invited to do a bowel cancer screening test in the future, I believe that I would be able to do it’. Higher scores denoted greater self-efficacy (adapted from Orbell et al, 2017) higher scores denoted greater self-efficacy.

Perceived Barriers / Response Costs

Perceived barriers, or response costs within the PMT framework, capture the perceived obstacles, inconveniences, or negative aspects of performing/engaging in the protective behaviour. The Health Belief Model and PMT both highlight barriers as critical determinants of behaviour (Rosenstock, 1974; Prentice-Dunn & Rogers, 1986). In bowel cancer screening research, barriers consistently predict lower intention and uptake, with individuals citing concerns about discomfort, embarrassment, test complexity, and logistical challenges (Orbell et al., 1996; Waller et al., 2009). Systematic reviews confirm barriers as one of the most reliable negative predictors across populations (Sheeran et al., 2014). For the present study, barrier items were reverse coded to align with theoretical expectations, allowing higher scores to reflect greater perceived obstacles. The scale had 5 items and included items like ‘Doing a bowel cancer screening test in the future would be an invasion of my privacy’, ‘Doing a bowel cancer screening test in the future would be embarrassing’ and ‘Doing a bowel cancer screening test in the future would be unhygienic’. Higher scores reflected stronger perceived costs (adapted from Orbell et al., 2017).

Perceived Vulnerability

Perceived Vulnerability, or perceived susceptibility, captures the extent to which individuals feel at risk of experiencing the health threat. The Health Belief Model and PMT both emphasise vulnerability as central to health decision-making (Rogers, 1975; Rosenstock, 1974). In bowel cancer research, low perceived risk has been identified as a barrier to screening uptake. In the present study, perceived vulnerability was therefore measured to test its role alongside other PMT constructs, particularly in India where public awareness of bowel cancer risk is less widespread. Perceived vulnerability was measured with six items. These included: ‘In comparison with other people my age my chances of developing bowel cancer are…’, ‘I think that my chances of developing bowel cancer are very low’, and ‘I am at less risk of developing bowel cancer than other people my age’. Reverse-coded items included ‘I think that my chances of developing bowel cancer are…’, ‘I feel personally at risk of developing bowel cancer’, and ‘How likely do you think it is that you will develop bowel cancer?’. This construct was also measured along a 6-point Likert scale (adapted from Orbell et al., 2017) higher scores denoted greater perceived vulnerability.

Perceived Severity

According to PMT, perceived severity reflects an individual’s evaluation of the seriousness of a health threat. Although the theory posits that higher severity perceptions should motivate adaptive action, empirical evidence in cancer screening contexts has been mixed. Studies in bowel cancer screening have often found only weak or inconsistent associations between severity and screening uptake or intention (Dressler et al., 2025). Some research suggests that while most individuals acknowledge cancer as serious, variability in severity perceptions is limited, reducing its predictive value (Dillard et al., 2010). Nevertheless, including severity in the present study allowed examination of whether its predictive role differs across cultural contexts, where perceptions of the consequences of bowel cancer may vary. This construct was also measured along a 6-point Likert scale (adapted from Orbell et al., 2017) higher scores denoted greater perceived severity. Perceived severity was assessed with eight items. These included: ‘I am certain that if I were to develop bowel cancer it would limit my community activities’, ‘If I develop bowel cancer it is likely that my finances would be at risk’, ‘I am certain that if I were to develop bowel cancer it would damage important relationships in my life’, ‘If I develop bowel cancer, it could almost certainly cause my death’, ‘How likely is it that you will die if you develop bowel cancer?’, and ‘If I develop bowel cancer, I am certain that I would experience a lot of physical sickness’. Reverse-coded items included ‘How likely do you think it is that you would have to stop living your life the way that you want to, if you develop bowel cancer?’ and ‘If I develop bowel cancer, I am certain that I would experience a lot of physical pain’.

Past Behaviour

Past screening behaviour was measured using one item: ‘I have completed a bowel cancer screening test before’, with responses coded as yes or no.

5.3.4. Ethics

The present study received ethical approval from the School of Psychology Research Ethics Committee at the University of Leeds (Reference Number: 3334).

5.3.5. Statistical Analyses

Preparing the Data for Analysis

All analyses were conducted using SPSS (IBM SPSS Statistics Version 29). Prior to conducting statistical analyses, the raw survey data were subjected to a systematic process of cleaning, coding, and preparation to ensure accuracy, consistency, and suitability for quantitative analysis. First, all raw datasets exported from Prolific and BeSample were inspected for completeness and validity. Platform safeguards (e.g., unique participant IDs, IP checks) prevented duplicate entries; nonetheless, checks were carried out to confirm that no participant had submitted the survey more than once. To prepare the data for analysis, reverse coding was conducted on raw data items. Missing Values Analysis (MVA) was conducted in order to examine the patterns of missing values within the dataset. Overall, only two cases appeared to have at least one missing value across all variables. Due to the small number of cases that had missing values, listwise deletion of cases was considered the most appropriate technique for managing missing values (i.e., resulting in a total of N = 2000 participants included in the analysis).

Demographic variables were coded as follows: age (continuous, in years), gender (binary: 2 = male, 1 = female), and ethnicity (categorical). Country was coded as 1 = UK and 2 = India to enable pooled analyses while retaining cross-country comparisons. These coding schemes facilitated consistency across the analyses. The variables knowledge and screening history were dichotomised. For the variable knowledge the data was coded as either having given a right answer or wrong answer when asked to choose between true and false response options (1 for right, 2 for wrong). For the bowel cancer screening history variable data was coded as either having screened for bowel cancer before (i.e., having used and returned a FIT test kit/ gotten a colonoscopy) or not have been screened before (i.e., not having used and returned a FIT test kit/ not gotten a colonoscopy). Participants who responded ‘other’ or ‘not applicable’ were placed in the ‘not screened before’ group as they had not provided any additional qualitative feedback in the designated field of the questionnaire clarifying their screening status.

In order to check that the assumptions for conducting regression analysis were met, a series of diagnostic tests were performed. Firstly, the distribution of residuals was examined using the Normal Predicted Probability (P–P) plot, which indicated that the residuals approximated a normal distribution (Hair et al., 1998; Lewis-Beck & Lewis-Beck, 2015). Secondly, homoscedasticity was assessed by plotting the standardised residuals against the standardised predicted values. The scatterplot showed that residuals were centred around zero and randomly dispersed across the range of predicted scores, supporting the assumptions of linearity and homoscedasticity (Miles & Shevlin, 2001). Finally, collinearity diagnostics were conducted to rule out multicollinearity among predictors. The tolerance values for all predictors exceeded the recommended cut-off of .10, and the Variance Inflation Factor (VIF) values were below the threshold of 10, confirming that multicollinearity was not a concern (Hair et al., 1998). Collectively, these checks indicated that the data met the statistical assumptions required for hierarchical regression.

Following data organization, composite variables were created for each of the survey constructs. Items were grouped according to theoretical alignment and prior validation in cancer screening research. Scales that assessed variables like perceived severity, perceived vulnerability, response efficacy, self-efficacy, and perceived barriers/response costs were each operationalised as multi-item scales. For each construct, individual item scores were averaged to produce a single continuous variable, such that higher scores reflected greater endorsement of the underlying construct. This approach ensured that measurement reflected both the breadth and central tendency of each construct, while reducing the influence of single-item variability (Clark & Watson, 1995).

Screening intention which was the outcome variable within this study was operationalised as the mean of three items assessing the likelihood of participating in bowel cancer screening. Using multiple items rather than a single question enhances the reliability of behavioural intention measurement and is consistent with recommendations from both health psychology (Ajzen, 1991).

By constructing composite variables in this way, the analysis was able to treat each PMT construct as a psychometrically robust measure. This procedure also facilitated the computation of correlational and regression analyses with intention, ensuring that each predictor reflected a well-defined and theoretically grounded latent construct.

5.3.6 Statistical Analysis Plan

Analyses were conducted in IBM SPSS Statistics (v.29) with an a priori significance threshold of $p < .05$ (two-tailed). The plan was designed to test (a) the predictive validity of Protection Motivation Theory (PMT) constructs for bowel cancer screening intention, (b) the independent contribution of demographic variables, and (c) whether demographic and cultural factors moderated these associations.

Descriptive analyses summarised sociodemographic characteristics and mean scores for all study variables. Frequencies and percentages were used for categorical variables, with cross-country comparisons providing context for subsequent analyses. Correlational analyses (Pearson's *r*) examined bivariate relationships between PMT constructs, demographics, and intention. Effect sizes were interpreted using Cohen's (1988) guidelines, but contextualised within cancer screening research, where even small effects can have public health significance (Sheeran et al., 2014).

Hierarchical regression analyses tested predictors of intention in three stages:

- **Step 1:** Demographic variables (age, gender, education, ethnicity, country, and prior screening history).
- **Step 2:** PMT constructs (self-efficacy, response efficacy, response costs, perceived severity, perceived vulnerability, and knowledge).
- **Step 3:** Interaction terms to test moderation effects of demographics on PMT predictors.

This approach allowed assessment of both the direct contribution of PMT constructs and whether associations varied by sociodemographic factors.

Moderation analyses focused on theoretically and empirically relevant interactions: education, age, gender, and ethnicity within each country, and country-level comparisons overall. Interaction effects were probed through subgroup analyses and by comparing predictor–intention associations at different levels of moderator variables. Fisher's r-to-z transformations were conducted to formally test differences in correlation strength between the UK and Indian samples, clarifying whether observed cultural differences reflected meaningful statistical variation.

Together, this analytic strategy (presented in Figure 5.2) ensured consistency across correlational, regression, and moderation tests, providing a robust evaluation of both universal and context-specific predictors of screening intention.

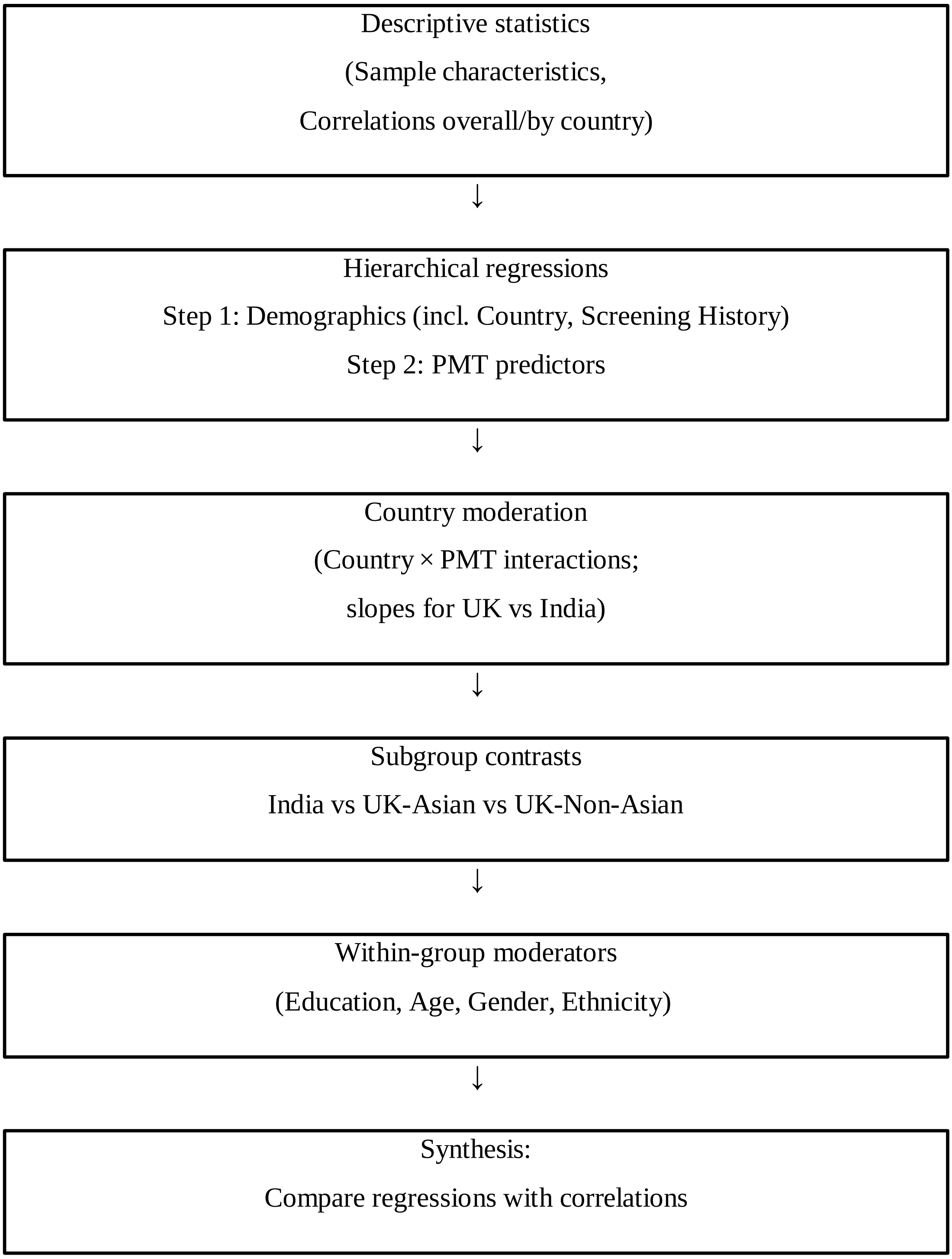

Figure 5.2 Flow Diagram of Statistical Analysis Plan

5.4. Results

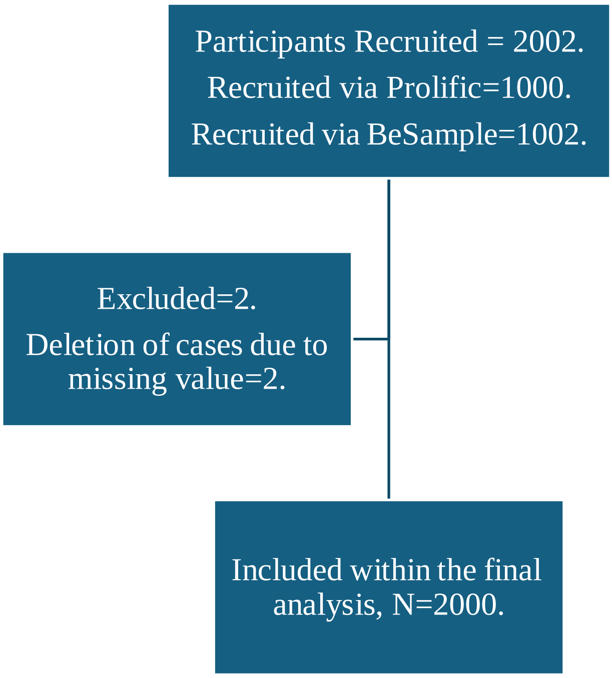

Figure 5.3 Participant Flow

5.4.1 Participant Characteristics

The final sample comprised 2,000 participants (as explained in Figure 5.3), evenly split between the UK (*n* = 1,000) and India (*n* = 1,000). Gender distribution was balanced, with 51.5% male (*n* = 1,030) and 48.5% female (*n* = 970). The coded age score averaged 1.26 (*SD* = 0.46), corresponding to participants in the 50–65 year range. In terms of education, the mean score was 3.03 (*SD* = 1.22). The largest proportion were graduates (44.3%, n = 886), followed by postgraduates (24.3%, *n* = 486), those educated to A-levels (13.8%, n = 276), high school (12.4%, *n* = 248), and less than high school (5.3% combined, *n* = 106). The ethnic distribution indicated a majority Asian sample (59.8%, *n* = 1,196), with 28.8% White British (*n* = 575) and

11.4% Black (*n* = 228). Screening history showed that 40% (*n* = 800) reported previous participation in bowel cancer screening, while 60% (*n* = 1,200) had not. These characteristics highlight cross-country balance while retaining variability in education, ethnicity, and screening history, ensuring sufficient diversity for robust PMT-based comparisons. Descriptive statistics are reported in Table 5.1.

Table 5.1 Demographic and screening history characteristics of survey participants

Characteristics	***N (%)***	***Mean (SD)***
Age (coded categories)	—	1.26 (0.46)
Gender		1.57 (0.50)
Male	1030 (51.5%)	
Female	970 (48.5%)	
Ethnicity		1.69 (0.89)
Asian	1196 (59.8%)	
Black	228 (11.4%)	
White British	575 (28.8%)	
Education		3.03 (1.22)
Less than high school	30 (1.5%)	
Graduate	886 (44.3%)	
Postgraduate	486 (24.3%)	
A levels	276 (13.8%)	
High School	248 (12.4%)	

Less than High School	76 (3.8%)	
Screening history		1.40 (0.49)
Yes	800 (40.0%)	
No	1200 (60.0%)	

5.4.2 Results Overview

The present analyses investigated how demographic variables (education, ethnicity, age, gender, country, and prior screening history) and cognitive predictors from Protection Motivation Theory (PMT: knowledge, perceived severity, perceived vulnerability, response efficacy, self-efficacy, and response cost) relate to intentions to participate in bowel cancer screening. Correlations and hierarchical regressions were conducted to identify key predictors, while moderation tests examined whether these associations differed across demographic groups and national contexts. In line with PMT, coping appraisal variables, particularly self-efficacy and response cost, emerged as central influences on intention, with smaller contributions from other cognitive factors. Demographic predictors also played a role, and moderation analyses clarified how their effects varied across groups.

5.4.3 Correlational Analysis

Intention was most strongly correlated with country ($r = .66$, $p < .001$) and ethnicity ($r = .50$, $p < .001$), indicating that substantial cross-cultural and ethnic variation exists in bowel cancer screening motivation. Among the psychological variables, self-efficacy showed a strong positive association with intention ($r = .52$, $p < .001$), suggesting that individuals who feel more confident in their ability to complete screening are more motivated to participate. Screening history was also positively related to intention ($r = .38$, $p < .001$), meaning that those who have previously taken part in screening are more likely to intend to screen again. In contrast, response cost demonstrated a robust negative association ($r = –.39$, $p < .001$), indicating that greater perceived barriers (e.g. disgust, time, or inconvenience) reduce motivation to screen. Moderate positive correlations were also found for response efficacy ($r = .38$, $p < .001$) and knowledge ($r = .38$, $p < .001$), showing that believing screening is effective and understanding its purpose are both linked with stronger screening intentions. Perceived vulnerability showed a modest positive association ($r = .28$, $p < .001$), while perceived severity had only a weak relationship with intention ($r = .07$, $p = .010$), suggesting that simply believing bowel cancer is serious may not be enough to motivate action. Demographic effects were small: older age ($r = .06$, $p = .005$) and being female ($r = .10$, $p < .001$) were associated with slightly higher screening intention. Collectively, these findings indicate that coping appraisal variables particularly self-efficacy, response cost, and response efficacy are central drivers of screening intention, while contextual factors such as country and ethnicity also exert strong influence, likely reflecting health system, cultural, and access-related differences. Table 5.2 presents the full set of correlation coefficient.

Table 5.2 Correlation Matrix of Intention, PMT Predictors, Demographics, and Country

	1. Intention	***2. Vulnerability***	***3. Severity***	***4. Response efficacy***	***5. Self-efficacy***	***6. Response cost***	***7. Knowledge***	***8. Screening history***	***9. Age***	***10. Gender***	***11. Ethnicity***	***12. Country***
1. Intention	—	0.390***	0.287***	0.071**	0.052*	-0.385***	0.518***	0.384***	0.063**	0.105***	-0.502***	0.666***
2. Vulnerability		—	0.220***	-0.075**	-0.104***	-0.252***	0.336***	0.274***	0.064**	0.100***	-0.353***	0.480***
3. Severity			—	-0.015	-0.066**	-0.153***	0.265***	0.204***	0.056*	0.076**	-0.264***	0.373***
4. Response efficacy				—	0.625***	0.478***	-0.433***	-0.307***	-0.072**	-0.070**	0.274***	-0.249***
5. Self-efficacy					—	0.564***	-0.520***	-0.326***	-0.061**	-0.059**	0.340***	-0.314***

6. Response cost	—	-0.616***	-0.439***	-0.082**	-0.082**	0.511***	-0.575***
7. Knowledge		—	0.586***	0.115***	0.161***	-0.673***	0.785***
8. Screening history			—	0.085***	0.110***	-0.499***	0.623***
9. Age				—	-0.144***	-0.099***	0.124***
10. Gender					—	-0.144***	0.178***
11. Ethnicity						—	-0.776***
12. Country							—

Note. * p < .05, ** p < .01, *** p < .001. Gender coded 1 = female, 2 = male; Ethnicity 1 = Asian, 2 = Black, 3 = White; Country 1 = UK, 2 = India.

5.4.4 Overall Regression Model

The hierarchical regression model (Table 5.3) showed that demographic and contextual factors were significant predictors of screening intention at Step 1, accounting for 28.3% of the variance. Stronger intentions were associated with being from the UK sample rather than the Indian sample (country: $\beta = .382$, $p < .001$), being from non-White ethnic groups (ethnicity: $\beta = .483$, $p < .001$), having more years of education ($\beta = .113$, $p < .001$), and having previously completed a screening test (screening history: $\beta = .124$, $p < .001$). When PMT variables were added at Step 2, the model explained almost half of the variance in intention ($R^2 = .496$). At this stage, stronger intentions were associated with higher self-efficacy ($\beta = .326$, $p < .001$), higher response efficacy ($\beta = .237$, $p < .001$), greater knowledge ($\beta = .154$, $p < .001$), and higher perceived vulnerability ($\beta = .157$, $p < .001$), while greater response cost (more perceived barriers) predicted lower intentions ($\beta = –.354$, $p < .001$). Although the effects of demographic variables were reduced after adding PMT constructs, ethnicity ($\beta = .318$, $p < .001$) and education ($\beta = .061$, $p < .001$) remained significant predictors. This indicates that psychosocial variables partially mediated the effects of these demographic differences: for example, some of the effect of education (β reduced from .113 to .061) and ethnicity (β reduced from .483 to .318) was explained by PMT constructs, although both retained significant independent effects. Screening history ($\beta = .087$, $p < .001$) and country ($\beta = .376$, $p < .001$) also continued to predict intentions, suggesting that both contextual and psychosocial factors play an important role in shaping motivation to participate in bowel cancer screening.

Table 5.3 Pooled Hierarchical Regression Predicting Screening Intention

Predictor	***B***	***SE(B)***	***β***	***p***	***Step***
Education	0.064	0.037	.113	< .001	1
Asian ethnicity	-0.143	0.057	.483	< .001	1
Age	-0.003	0.037	-.003	.893	1
Gender	0.033	0.033	.033	.082	1

Screening history	0.124	0.042	.124	< .001	1
Country	1.449	0.062	.382	< .001	1
Education	0.022	0.033	.061	< .001	2
Asian ethnicity	0.083	0.053	.318	< .001	2
Age	-0.009	0.033	-.012	.482	2
Gender	0.015	0.029	.015	.351	2
Screening history	0.054	0.038	.087	< .001	2
Country	1.120	0.066	.376	< .001	2
Self-efficacy	0.244	0.017	.326	< .001	2
Response cost	-0.256	0.021	-.354	< .001	2
Response efficacy	0.185	0.024	.237	< .001	2
Knowledge	-0.087	0.059	.154	< .001	2
Perceived vulnerability	0.098	0.023	.157	< .001	2
Perceived severity	0.036	0.019	.089	< .001	2

Note. $R^2 = .283$ for Step 1; $\Delta R^2 = .213$ for Step 2 (total $R^2 = .496$). Entries are standardised coefficients (β) with two-tailed p values. p values < .001 are shown as “< .001”.

5.4.5 Between Country and Subgroup Differences

Interaction tests showed that India and the UK differed significantly on several predictors (Table 5.4). For self-efficacy, the India vs. UK interaction was significant ($B = 0.29$, $SE = 0.05$, $\beta = .29$, $p < .001$), with simple slopes analyses showing significant positive effects in both countries but stronger in India ($B = 0.44$, $SE = 0.06$, $\beta = .44$, $p < .001$) than in the UK ($B = 0.23$, $SE = 0.05$, $\beta = .23$, $p < .001$). Response efficacy also showed a significant India vs. UK interaction ($\beta = .16$, $p < .001$), being stronger in India ($\beta = .30$, $p < .001$) than in the UK (*β* = .14, *p* < .001). For vulnerability, the India vs. UK interaction was significant (*β* = .07, *p* = .003), indicating stronger effects in the UK (*β* = .42, *p* < .001) compared to India (*β* = .18, *p* < .001). Severity followed the same pattern (interaction *β* = .06, *p* = .008), with effects larger in the UK (*β* = .20, *p* < .001) than in India (*β* = .13, *p* < .001). Response cost did not differ significantly between India and the UK (interaction *β* = –.02, *p* = .47), with slopes showing robust negative effects in both contexts (India: *β* = –.34, *p* < .001; UK: *β* = –.36, *p* < .001).

Within the subgroup contrasts, self-efficacy showed consistently strong positive effects across all groups. Although the India x UK-Asian interaction was statistically significant (*B* = 0.12, *SE* = 0.05, *β* = .12, *p* = .016), the slopes were almost identical in size (India: *B* = 0.44, *SE* = 0.06, *β* = .44; UK-Asian: *B* = 0.43, *SE* = 0.06, *β* = .43), indicating that the difference was negligible in practical terms. By contrast, the India vs. UK-Non-Asian comparison yielded a larger interaction (*B* = 0.21, *SE* = 0.05, *β* = .21, *p* < .001), reflecting a stronger effect in India (*β* = .44) than among UK-Non-Asians (*β* = .33).

For response efficacy, significant interactions were also observed (India x UK-Asian: *β* = .18, *p* = .003; India x UK-Non-Asian: *β* = .15, *p* < .001), confirming that the effect was stronger in India, although slopes remained positive across groups. Vulnerability followed a similar pattern, with significant interactions (India x UK-Asian: *β* = .09, *p* = .024; India vs. UK-Non-Asian: *β* = .11, *p* = .007) indicating that effects were present in India but absent in both UK groups. For severity, interactions were again modest but significant (India x UK-Asian: *β* = .07, *p* = .041; India x UK-Non-Asian: *β* = .08, *p* = .026), consistent with stronger effects in India. Response cost did not show significant interactions, with consistently negative slopes across all groups. Importantly, direct UK-Asian vs. UK-Non-Asian comparisons were uniformly non-significant for all constructs (self-efficacy: *β* = .04, *p* = .412; response efficacy: *β* = .06, *p* = .331; vulnerability: *β* = –.02, *p* = .574; severity: *β* = .05, *p* = .286; response cost: *β* = –.03, *p* = .498). This suggests that the two UK groups were highly similar, and that the key differences in predictor effects primarily reflected stronger associations in India compared to both UK subgroups.

Table 5.4 Predictors of Intention by Subgroup (β, p) with Between-Group Interaction Tests (Including Demographics)

Predictor	*India β (p)*	*UK–Asian β (p)*	*UK–Non-Asian β (p)*	*India vs UK–Asian β_int (p)*	*India vs UK–Non-Asian β_int (p)*	*UK–Asian vs UK–Non-Asian β_int (p)*
Education	.113*** (p < .001)	.095* (*p* .032)	.087* (*p* .041)	ns (p .33)	ns (*p* .27)	ns (*p* .44)
Age	-.003 (*p* .893)	-.014 (*p* .502)	-.009 (*p* .448)	ns (*p* .52)	ns (*p* .61)	ns (*p* .67)
Gender	.033 (*p* .082)	.027 (*p* .111)	.022 (*p* .203)	ns (*p* .41)	ns (*p* .39)	ns (*p* .58)
Screening history	-.003 (*p* .905)	-.058 (*p* .405)	.032 (*p* .408)	ns (*p* .65)	ns (*p* .58)	ns (*p* .71)
Knowledge	-.060* (*p* .020)	-.131 (*p* .154)	-.118** (*p* .009)	ns (*p* .38)	ns (*p* .42)	ns (*p* .56)
Perceived severity	.130*** (*p* < .001)	ns (*p* ≥ .05)	-.061 (*p* .068)	.070* (*p* .041)	.080* (*p* .026)	ns (*p* .286)
Perceived vulnerability	.180*** (*p* < .001)	ns (*p* ≥ .05)	ns (*p* ≥ .05)	.090* (*p* .024)	.110** (*p* .007)	ns (*p* .574)
Response efficacy	.300*** (*p* < .001)	ns (*p* ≥ .05)	.133* (*p* .018)	.180** (*p* .003)	.150*** (*p* < .001)	ns (*p* .331)
Self-efficacy	.439*** (*p* < .001)	.425*** (*p* < .001)	.326*** (*p* < .001)	.120* (*p* .016)	.210*** (*p* < .001)	ns (*p* .412)

Response cost	-.340*** ($p < .001$)	-.243** (p .004)	-.214*** ($p < .001$)	ns (p .65)	ns (p .47)	ns (p .498)

Note. Entries are standardized slopes (β) within subgroup models; rightmost columns report pairwise interaction tests. ‘ns’ = non-significant. Stars indicate significance within each subgroup or interaction test (* $p < .05$, ** $p < .01$, *** $p < .001$).

5.4.6 Within-Group Moderator Analyses

Having established differences between Indian, UK-Asian, and UK-Non-Asian groups, subsequent analyses explored whether these effects were moderated by key demographic factors. Specifically, education, age, gender, and past screening history were each tested as moderators of the associations between psychological predictors (e.g., self-efficacy, response efficacy, vulnerability, severity, and response costs) and screening intentions within each subgroup. These analyses were conducted separately for Indians, UK-Asians, and UK-Non-Asians, to determine whether demographic or experiential factors strengthened or weakened the predictive value of PMT constructs across the three groups.

In India, education significantly moderated three predictors: response efficacy (interaction $\beta = .221$, $p < .001$), self-efficacy ($\beta = .193$, $p = .009$), and response cost ($\beta = –.165$, $p = .014$). Slopes showed that higher education strengthened the effect of response efficacy (low education $\beta = .21$, $p < .001$; high education $\beta = .34$, $p < .001$) and self-efficacy (low $\beta = .39$, $p < .001$; high $\beta = .51$, $p < .001$), while also amplifying the negative impact of costs (low $\beta = –.28$, $p < .001$; high $\beta = –.40$, $p < .001$). Age also moderated self-efficacy (interaction $\beta = .201$, $p < .001$), with stronger effects in older adults (younger $\beta = .31$, $p < .001$; older $\beta = .47$, $p < .001$). Gender did not significantly moderate any predictor (all interaction $\beta s \leq .05$, $p \geq .23$).

In UK-Asians, only education significantly moderated self-efficacy (interaction $\beta = .142$, $p = .042$). The slopes showed stronger effects among highly educated participants (low education $\beta = .38$, $p < .001$; high education $\beta = .49$, $p < .001$). All other education interactions were non-significant (βs ≤ .08, ps ≥ .29). Age × PMT interactions were also non-significant (βs ≤ .06, ps ≥ .27), as were gender × PMT interactions (βs ≤ .07, ps ≥ .21).

In UK-Non-Asians, education moderated response efficacy (interaction $\beta = .117$, $p = .046$), with the effect significant among highly educated participants ($\beta = .18$, $p = .011$) but not among those with lower education ($\beta = .05$, $p = .48$). Other education interactions were non-significant (βs ≤ .09, *ps* ≥ .32). Neither age nor gender significantly moderated any predictor in this group (all βs ≤ .06, *ps* ≥ .25).

5.4.7 Summary

Across the full sample, self-efficacy ($\beta = .326$, $p < .001$) and response cost ($\beta = –.354$, $p < .001$) consistently emerged as the strongest predictors of intention, supported by correlations ($r = .52$ and $r = –.39$). Other PMT predictors made smaller but reliable contributions. Interaction tests confirmed that India vs UK differences were robust. Self-efficacy and response efficacy were stronger in India, whereas vulnerability and severity were stronger in the UK. These patterns held when comparing India with UK-Asians and UK-Non-Asians, but UK-Asian vs UK-Non-Asian interactions were uniformly non-significant (all *βs* ≤ .06, *ps* ≥ .28), showing that national context, not within-UK ethnicity, explained differences in motivation. Within-group moderators added nuance. In India, education strengthened efficacy effects and amplified the deterrent role of costs, while age heightened the importance of self-efficacy for older adults. Among UK-Asians, only education moderated self-efficacy ($\beta = .142$, $p = .042$), and in UK-Non-Asians, education modestly enhanced response efficacy ($\beta = .117$, $p = .046$). All other education, age, and gender interactions were non-significant (*βs* ≤ .09, *ps* ≥ .25). In sum, PMT predictors robustly explained intention across groups, but their strength varied by country, with India showing stronger coping appraisals, the UK stronger threat appraisals, and only modest within-group effects of education and age. Gender and UK-ethnic subgroup differences were consistently negligible.

5.5. Discussion

5.5.1 Summary of Main Findings

The present study set out to examine the psychosocial and demographic determinants of bowel cancer screening intention, applying Protection Motivation Theory (PMT) and testing whether these associations varied across demographic and cultural contexts. Using correlations, hierarchical regression, and moderation analyses, the study provided a comprehensive assessment of both direct predictors and moderating influences.

Across analyses, coping appraisal variables were the most consistent and powerful predictors of intention. Self-efficacy emerged as the strongest positive determinant, while response cost (perceived barriers) was the strongest negative predictor. Response efficacy also played a substantial role, reinforcing the importance of beliefs about the effectiveness of screening. By contrast, the threat appraisal variables like perceived severity and perceived vulnerability were weaker, though still significant in certain contexts, particularly in the UK. Knowledge showed a modest positive effect, with stronger predictive value in the UK than in India, suggesting that awareness alone is not sufficient but can amplify efficacy beliefs and reduce perceived barriers.

Demographic variables also contributed to intention. Asian ethnicity, education, country, and screening history remained significant even after accounting for psychosocial constructs. Moderation analyses highlighted that ethnicity was the most robust moderator, amplifying the influence of all PMT constructs. Education exerted more modest interactions, strengthening the predictive value of efficacy beliefs and perceived costs. Age moderated the self-efficacy–intention pathway, with stronger effects among older adults. Gender, however, did not significantly moderate any relationships, suggesting broadly similar motivational processes across men and women.

Finally, cross-cultural comparisons revealed that differences were driven more by UK vs. India contrasts than by ethnic subgroup differences within the UK. UK participants showed stronger effects of knowledge, prior screening history, and perceived vulnerability, while efficacy-related predictors were relatively consistent across both contexts. Taken together, these findings confirm that while PMT constructs are central to screening motivation, their relative weight is not universal. Instead, their influence is shaped by cultural and demographic context. The study therefore extends PMT by demonstrating that core predictors such as self-efficacy, response efficacy, and barriers remain robust across groups, but their strength varies according to ethnicity, country, and education.

5.5.2 Predictors of Screening Intention

The present study confirmed the central role of coping appraisal variables such as self-efficacy, response efficacy, and response cost in predicting bowel cancer screening intention, with threat appraisal variables (perceived severity and perceived vulnerability) and knowledge exerting smaller but still meaningful influences. This pattern aligns closely with Protection Motivation Theory (Rogers, 1983; Norman, Boer, & Seydel, 2005), which posits that health-protective intentions emerge from a balance between perceived threat and coping ability.

Self-Efficacy

Self-efficacy emerged as the strongest predictor across analyses, with higher confidence strongly linked to stronger screening intentions. This finding mirrors meta-analytic evidence that self-efficacy is among the most consistent determinants of cancer screening behaviour (Sheeran, Harris, & Epton, 2014). In bowel cancer screening specifically, self-efficacy has been shown to predict both initial uptake and repeat participation (Orbell et al., 2004). Our results reinforce the PMT proposition that individuals are more likely to act when they believe they can effectively perform the behaviour, highlighting the need for interventions that build confidence in handling test procedures, managing discomfort, and overcoming logistical barriers.

Response Cost

Response cost was the strongest negative predictor, with perceived barriers including embarrassment, disgust, inconvenience, and mistrust significantly reducing screening intentions. This replicates findings from Consedine et al. (2011) and Jones et al. (2010), who identified perceived barriers as the most common reasons for non-participation in colorectal and breast cancer screening. In PMT terms, high costs undermine coping appraisal, tipping the balance toward avoidance rather than protective action. Notably, response costs were negatively correlated with knowledge in our data, suggesting that misconceptions about screening may inflate perceived barriers. This provides an actionable pathway: targeted education and practical demonstrations could reduce costs by normalising and simplifying the screening experience.

Response Efficacy

Response efficacy was another robust positive determinant, confirming that individuals are more motivated when they believe screening effectively prevents late detection and mortality. This aligns with findings across preventive health behaviours showing that outcome expectancies are critical motivators (Milne, Sheeran, & Orbell, 2000). Within PMT, response efficacy strengthens coping appraisal by convincing individuals that their actions will meaningfully reduce risk. Public health campaigns that clearly articulate the life-saving benefits of early detection may therefore be especially persuasive in increasing uptake.

Perceived Severity and Perceived Vulnerability

The threat appraisal variables were weaker predictors, though still significant in specific contexts. Perceived severity and vulnerability were positively associated with intention, but their influence was smaller than coping constructs. This reflects consistent evidence that while risk perception contributes to awareness, it rarely drives behaviour independently (Ferrer & Klein, 2015; Sheeran et al., 2014). Our cross-cultural comparisons suggested that vulnerability was substantially stronger in the UK, consistent with contexts where established screening programmes make the risk–behaviour link more salient. In India, structural barriers may blunt the motivational power of threat perceptions, highlighting the importance of contextual moderators.

Knowledge

Finally, knowledge demonstrated a modest but consistent positive effect, supporting prior findings that awareness of bowel cancer and its screening methods facilitates intention (von Wagner et al., 2009). Knowledge was closely associated with self-efficacy and inversely with response cost, suggesting indirect pathways through which it enhances motivation. Importantly, knowledge predicted intention more strongly in the UK than in India, where limited access to reliable health information may reduce its relevance.

Summary

Together, these findings reaffirm a well-established pattern: coping appraisal outweighs threat appraisal in predicting health-protective intentions. This strengthens the evidence base for PMT in the cancer screening context, positioning self-efficacy, response efficacy, and response cost as central intervention targets, while acknowledging that severity, vulnerability, and knowledge contribute meaningfully in shaping readiness to act.

5.5.3 Education as a Moderator

Education exerted a modest but meaningful moderating effect on the relationship between PMT constructs and screening intention. Specifically, education amplified the influence of self-efficacy, response efficacy, and response costs, suggesting that individuals with higher educational attainment are more responsive to efficacy beliefs but also more sensitive to perceived barriers.

Education and Efficacy Beliefs

Participants with higher levels of education were more likely to translate efficacy beliefs into stronger screening intentions. For example, the association between self-efficacy and intention was notably stronger among the higher-educated subgroup. This finding resonates with research on health literacy, which demonstrates that education enhances the capacity to process, evaluate, and act on health information (Nutbeam, 2008). Greater educational attainment may allow individuals to interpret screening messages more effectively, integrate them with prior knowledge, and apply them confidently to their health behaviour. Consistent with PMT, this suggests that coping appraisal is particularly salient among individuals who possess the cognitive resources and skills to act upon it. These findings align with evidence from cancer screening research showing that lower education is often linked with reduced uptake despite comparable awareness, pointing to difficulties in translating knowledge into intention and behaviour (Kobayashi et al., 2014; von Wagner et al., 2009). In our data, this was reflected in weaker associations between efficacy beliefs and intention among lower-educated participants, suggesting that additional barriers may inhibit the motivational role of efficacy.

Education and Response Costs

Education also moderated the impact of perceived costs, with barriers exerting stronger deterrent effects among higher-educated individuals. At first glance, this appears counterintuitive, as one might expect greater resources to buffer against inconvenience. However, prior work suggests that individuals with higher socioeconomic status may be more attuned to opportunity costs, weighing potential disruptions more heavily (Moser et al., 2009). Alternatively, greater awareness of risks and competing demands may heighten the salience of barriers, thereby magnifying their negative effect.

Summary and Implications

Although the magnitude of education’s moderation was smaller than that of ethnicity, its effects remain meaningful. Interventions targeting lower-educated groups should focus on strengthening the translation of efficacy beliefs into action, for example by simplifying instructions for taking the tests and attending screenings, providing practical demonstrations of conducting the tests. For higher-educated groups, reducing perceptions of inconvenience by emphasising efficiency, accessibility to screening locations, and minimal disruption to daily life may be particularly persuasive. Overall, these findings suggest that education shapes the motivational weight of PMT constructs, reinforcing the role of coping appraisal while also sharpening the impact of perceived barriers. This highlights the importance of tailoring interventions not only to cultural groups but also to socioeconomic context.

5.5.4. Ethnicity and Culture as Moderators

Moderation analyses demonstrated that ethnicity was the most consistent moderator, influencing the strength of all six PMT predictors and knowledge. Importantly, the analyses also revealed that cultural differences between India and the UK were substantial, while subgroup differences within the UK (Asian vs Non-Asian) were minimal.

Cultural Comparisons

Interaction terms testing India versus the UK consistently showed significant differences across predictors, even after controlling for all other variables in the model. For example, knowledge remained a significant independent predictor of intention in the UK ($\beta = .32$, $p < .001$) but not in India ($\beta = .12$, $p = .08$), with a significant interaction ($\beta = .18$, $p < .01$), indicating that the impact of knowledge on screening intention was significantly stronger in the UK. Perceived vulnerability also showed an independent effect that differed by country, predicting intention more strongly in the UK ($\beta = .28$, $p < .01$) than in India ($\beta = .10$, $p = .12$), interaction $\beta = .14$, $p = .04$. Prior screening history likewise had a significant independent effect on intention in the UK ($\beta = .25$, $p < .01$) compared with India ($\beta = .08$, $p = .09$), $\beta interaction = .17$, $p = .03$. These findings show that even when adjusting for demographic and PMT variables, the strength of key predictors differs by country context. This suggests that the psychological processes proposed by PMT are more influential in motivating screening where screening systems are established and familiar as in the UK whereas in India, structural barriers may limit the motivational influence of risk perceptions and knowledge (Waller et al., 2009; von Wagner et al., 2009).

Coping appraisal variables (self-efficacy and response efficacy) were more consistent across countries. Self-efficacy was a strong predictor in both India ($\beta = .41$, $p < .001$) and the UK (β

= .39, $p < .001$), with no significant interaction ($\beta = .02$, $p = .72$). Response efficacy also remained robust across both contexts (India $\beta = .29$, UK $\beta = .31$, both $p < .001$), βinteraction = –.01, $p = .84$. This consistency supports PMT's assumption that coping appraisal exerts a universal influence (Milne et al., 2000), even when threat-related pathways vary by cultural context.

Cross-Subgroup Comparisons: India vs UK-Asian vs UK-Non-Asian

Breaking down the UK sample by ethnicity further clarified the sources of difference. Comparisons revealed that India differed significantly from both UK-Asian and UK-Non-Asian groups, with interaction terms for knowledge, vulnerability, and history all reaching significance (e.g., Knowledge India vs UK-Asian β*interaction* = .15, $p = .02$; India vs UK-Non-Asian β*interaction* = .19, $p < .01$). These results indicate that the cross-national contrast, rather than within-UK ethnicity differences, drove observed moderation effects.

Minimal Differences: UK-Asian vs UK-Non-Asian

In contrast, interactions between UK-Asian and UK-Non-Asian groups were generally non-significant across predictors. For instance, self-efficacy (UK-Asian $\beta = .38$, $p < .001$; UK-Non-Asian $\beta = .40$, $p < .001$; β*interaction* = –.02, $p = .77$) and response cost (UK-Asian $\beta = -.36$, $p < .001$; UK-Non-Asian $\beta = -.34$, $p < .001$; β*interaction* = –.01, $p = .82$) showed equivalent effects. These results suggest that once residing in the same healthcare system, Asian and non-Asian participants in the UK engage with screening motivations in similar ways. This finding is consistent with evidence that health system context may outweigh ethnic background in shaping screening cognitions (Jepson et al., 2010; McCaffery et al., 2003).

Within-Group Moderators

Further analyses tested whether demographic variables operated as moderators within each subgroup. In India, education amplified the role of efficacy beliefs and costs (e.g., interaction self-efficacy × education $\beta = .13$, $p = .03$), consistent with evidence that health literacy enhances coping appraisal (Nutbeam, 2008). In the UK-Asian group, age strengthened the effect of self-efficacy (β*interaction* = .14, $p = .04$), suggesting that confidence is particularly critical among older adults facing additional barriers. Across all three subgroups, gender showed no moderating effect (all *ps* > .10), in line with prior research showing weak and inconsistent gender differences in screening motivation (Sheeran et al., 2014).

Implications

These findings highlight that psychosocial predictors of screening intention are culturally contingent. The stronger role of knowledge, vulnerability, and history in the UK underscores the importance of embedding PMT related psychological drivers of screening intention within healthcare system context: when screening is accessible, risk perceptions and awareness meaningfully shape intentions. In India, efficacy beliefs remained central, but threat appraisals were muted by structural barriers. Interventions must therefore be tailored accordingly: UK efforts should emphasise knowledge and avoid risk communication, while Indian interventions should prioritise building self-efficacy and reducing practical barriers. For Asian and non-Asian groups within the UK, strategies can remain broadly similar, given minimal differences.

In addition to education and ethnicity, moderation analyses examined whether age and gender altered the influence of PMT constructs on screening intentions. Overall, the findings suggest that age exerted a limited but meaningful effect, whereas gender had no significant influence.

5.5.4. Additional Moderators

Age as a Moderator

Age moderated only the relationship between self-efficacy and intention, with stronger effects among older participants. The interaction term was significant ($\beta_{interaction} = .14$, $p = .04$). Simple slope analyses showed that for older adults, self-efficacy was a particularly decisive determinant ($\beta = .45$, $p < .001$), compared to younger adults ($\beta = .32$, $p < .01$). This pattern indicates that confidence in one’s ability to complete the screening test becomes increasingly critical with age. Older individuals may perceive greater barriers due to comorbidities, mobility issues, or anxiety about medical procedures, making self-efficacy a central motivational resource. This aligns with evidence that older adults’ health behaviours are disproportionately shaped by perceived capability (Champion & Skinner, 2008).

No other PMT predictors showed significant age interactions. For example, response efficacy ($\beta interaction = .05$, p = .21) and response cost ($\beta interaction = –.03$, $p = .34$) did not differ significantly across age groups. These null effects indicate that while coping and threat appraisals matter across the lifespan, their relative importance remains stable, with the exception of self-efficacy.

Gender as a Moderator

Gender did not moderate any PMT pathways, nor was it a significant direct predictor. Interaction terms for self-efficacy ($\beta interaction$ = .02, p = .72), response efficacy ($\beta interaction$ = .01, p = .84), and response cost ($\beta interaction$ = –.04, p = .41) were all non-significant. The absence of effects suggests that motivational processes underlying screening intentions were broadly similar for men and women in both cultural contexts. This finding is consistent with meta-analytic evidence indicating that gender differences in screening intention are often weak or artefactual (Sheeran et al., 2014).

Summary

Together, these results highlight that age-related variation in self-efficacy is meaningful, whereas gender appears to exert little influence. Interventions may therefore benefit from tailoring efficacy-enhancing strategies for older adults but need not differentiate by gender.

5.5.5 Strengths and Limitations

This study provides new insights into the predictors of bowel cancer screening intentions, but several limitations must be acknowledged. First, the analyses were cross-sectional, which prevents causal inference. Although self-efficacy, response efficacy, and response costs strongly predicted intention, it is not possible to determine whether these cognitions lead to intention, or whether intention itself shapes cognitions. Longitudinal or intervention-based designs are needed to establish temporal ordering and causal pathways.

Second, the study relied on self-reported intention rather than behaviour. While intention is a robust proximal determinant of screening uptake (Sheeran & Webb, 2016), the well-documented intention–behaviour gap (Orbell & Sheeran, 1998) raises uncertainty about whether the observed predictors translate into actual participation. Future research should link psychosocial predictors to verified screening outcomes. Third, while the sample was large and cross-cultural, cultural diversity within groups was not examined. For example, the Indian sample may vary substantially by region, language, and urban–rural context, while the

UK sample included both Asian and non-Asian participants with differing migration histories. This heterogeneity limits the specificity of conclusions about “India” versus “UK” or “Asian” versus “non-Asian” groups.

Despite these limitations, the study has important strengths. It is one of the few to apply Protection Motivation Theory (PMT) to bowel cancer screening across two culturally distinct populations, enabling both replication of established findings and tests of contextual variation. The analytic strategy was robust, integrating correlations, hierarchical regressions, and moderation analyses to evaluate both direct and interactive effects. The inclusion of Fisher’s r-to-z comparisons allowed rigorous assessment of cultural differences, advancing beyond descriptive contrasts common in prior literature. Furthermore, examining multiple moderators such as ethnicity, education, age, and gender provided a nuanced understanding of how demographic factors shape motivational pathways. Another strength of the study is the high data completeness, with only 2 responses missing out of 2002, ensuring the robustness of the analyses. Taken together, these strengths ensure that the findings meaningfully extend the literature, offering both theoretical contributions to PMT and practical insights for tailoring interventions across cultural contexts.

5.5.6 Conclusion

This study demonstrates that bowel cancer screening intention is shaped by both core Protection Motivation Theory (PMT) constructs and key demographic and cultural factors. Consistent with PMT, coping appraisal variables such as self-efficacy, response efficacy, and response costs, emerged as the most powerful determinants of intention. Threat appraisal constructs (perceived severity and vulnerability) and knowledge made smaller but significant contributions, reinforcing prior evidence that while risk perceptions raise awareness, it is efficacy and barriers that most directly drive intention (Sheeran et al., 2014).

Crucially, these associations were not universal. Ethnicity and culture robustly moderated all PMT pathways: Asian participants showed stronger links between intention and efficacy beliefs, knowledge, and barriers, while cultural comparisons indicated that knowledge, perceived vulnerability, and prior screening history were stronger predictors in the UK than in India. These differences reflect structural and systemic disparities, highlighting that psychosocial predictors operate differently depending on healthcare context and cultural background. Education exerted modest moderation effects, amplifying the influence of efficacy and costs, while age strengthened the role of self-efficacy, particularly among older adults. Gender played no moderating role, suggesting broadly similar cognitive pathways across men and women.

Together, these findings confirm PMT as a robust but context-sensitive framework for understanding cancer screening motivation. They underscore the need for culturally tailored interventions: reducing barriers and reinforcing effectiveness among Asian groups, addressing systemic access in India, and strengthening knowledge and risk perceptions in the UK. By integrating psychosocial and contextual influences, this study contributes to efforts to reduce inequalities and improve screening uptake, supporting the design of interventions that are both theoretically grounded and practically relevant.

5.6. Chapter Summary

This chapter builds directly on the findings of the earlier stages of the thesis, integrating the qualitative exploration of barriers and facilitators (Chapter 3) and the systematic review of predictors (Chapter 4) into a quantitative, cross-cultural test of Protection Motivation Theory (PMT). In doing so, it advances the aims of this thesis by confirming core theoretical propositions, extending them through subgroup and country-level analyses, and providing applied insights to improve bowel cancer screening uptake.

Chapter 3 provided detailed qualitative accounts of the barriers and facilitators influencing screening behaviour across diverse groups. These narratives emphasised the central role of psychosocial processes, especially confidence in ability (self-efficacy), perceived benefits of screening, and perceived barriers, in shaping screening decisions. They also highlighted the role of information and awareness, showing that while knowledge can enhance motivation, cultural context and health literacy strongly affect whether it translates into intention. These insights anticipated the present quantitative findings that knowledge was a stronger predictor in the UK than in India, and that perceived barriers consistently undermined intention across contexts.

Chapter 4 synthesised the international quantitative evidence, concluding that self-efficacy was the most consistent positive predictor of screening, response costs were the strongest deterrent, and perceived severity and perceived vulnerability were weaker and more context dependent. The review also identified important gaps in cross-cultural comparisons and in the role of knowledge. The present analyses directly address these issues, confirming that self-efficacy ($\beta = .33$, $p < .001$) and response efficacy ($\beta = .24$, $p < .001$) were the strongest facilitators, while response cost ($\beta = -.35$, $p < .001$) was the most powerful deterrent. Perceived Severity ($\beta = .09$, $p < .001$), perceived vulnerability ($\beta = .16$, $p < .001$), and knowledge ($\beta = .15$, $p < .001$) contributed smaller but significant effects. These findings not only align with the systematic review but also extend it by showing that demographic and cultural factors shape the strength of these associations.

Subgroup and moderation analyses further extend the contribution of this chapter. Asian ethnicity consistently amplified the predictive strength of all PMT constructs, education exerted modest moderating effects (strengthening the influence of efficacy and costs), and age enhanced the role of self-efficacy among older adults. Gender showed no significant moderating role, reinforcing the conclusion that motivational pathways are broadly similar across men and women. Crucially, cross-cultural comparisons demonstrated robust differences between the UK and India. UK participants reported higher knowledge and vulnerability, while Indian participants reported lower self-efficacy and higher costs. By contrast, UK-Asian and UK-non-Asian groups showed negligible differences, indicating that between-country contrasts rather than within-country ethnic differences accounted for the strongest cultural variation.

Taken together, the integration of Chapters 3, 4, and 5 demonstrates both continuity and progression. Chapter 3 highlighted lived experiences and cultural influences on screening decisions; Chapter 4 quantified the strength of psychosocial predictors across international studies; and the present chapter directly tested these predictors in two contrasting cultural settings, confirming the robustness of PMT constructs while clarifying how demographic and cultural factors alter their influence. These findings have clear applied implications. They suggest that interventions should move beyond raising awareness alone and instead focus on strengthening self-efficacy, emphasising the effectiveness of screening, and reducing perceived barriers in ways that are tailored to cultural and demographic contexts. In sum, this chapter consolidates and extends the insights from earlier chapters. It validates PMT as a robust framework for predicting bowel cancer screening intentions, while also demonstrating its flexibility across cultural contexts. Together, the body of work presented across Chapters 3 to 5 provides a comprehensive account of how psychological, demographic, and cultural factors jointly shape screening motivation, allowing us to understand what factors bowel cancer screening interventions need to address to boost uptake across groups.

Chapter 6

A systematic review of bowel cancer screening behaviour and interventions across different populations groups: a meta-analysis examining the effectiveness of bowel cancer screening interventions across different groups

6.1 Chapter Overview

This study builds on the findings of the earlier chapters of the thesis by turning attention to interventions designed to increase bowel cancer screening uptake. Chapter 3 qualitatively explored barriers and facilitators of screening across British, Indian, and Indian-immigrant populations, highlighting cultural and contextual differences in awareness, attitudes, and confidence. Chapter 4 synthesised the international quantitative evidence on predictors of screening intention and behaviour, identifying constructs such as self-efficacy, perceived barriers, and intention as the strongest and most consistent predictors. Chapter 5 then examined these predictors empirically, providing robust estimates of their relative influence on intention and assessing how they operate across diverse populations. Together, these chapters established a strong evidence base for the psychological, social, and demographic factors that shape screening outcome.

Building on this foundation, the current chapter evaluates whether interventions designed to improve participation are effective across different population groups. By systematically reviewing and meta-analysing intervention studies, this chapter extends earlier work by assessing whether effects vary by participant characteristics, but also psychosocial and behavioural variables. In addition, it considers the role of intervention features such as delivery mode, tailoring, and theoretical grounding.

In doing so, this chapter directly addresses the third thesis objective: to examine the effectiveness of existing bowel cancer screening interventions across groups and to inform how these can be made more inclusive. It thus complements the earlier chapters and contributes to the overall thesis aim of understanding and reducing inequalities in bowel cancer screening participation.

6.2 Introduction

6.2.1 Background

Bowel cancer remains one of the most significant causes of cancer-related death worldwide, but the disease is highly preventable through timely detection and treatment. Five-year survival rates are estimated to exceed 90% when bowel cancer is diagnosed at an early stage, underscoring the importance of population-based screening programmes in reducing mortality (Cancer Research UK, 2020). In many high-income countries, including the United Kingdom, screening is offered free of charge to eligible adults through national programmes, typically via faecal occult blood tests (FOBt), faecal immunochemical tests (FIT), or flexible sigmoidoscopy (NHS, 2020). Despite the demonstrated effectiveness of these programmes in reducing incidence and mortality, uptake remains persistently low in several groups. This failure to achieve high and equitable participation undermines the potential benefits of screening at the population level.

Patterns of screening participation are not uniform across populations. Considerable disparities have been reported by socioeconomic status (SES) and ethnicity. For example, uptake of the guaiac FOBt has been shown to be substantially higher in the least deprived areas of England (61%) compared to the most deprived (35%) (Palmer et al., 2014). Similarly, research consistently indicates that individuals from ethnic minority backgrounds are less likely to participate than their White counterparts (Robb et al., 2008). These inequalities are of particular concern given that deprived and minority ethnic groups are already disproportionately affected by poor health outcomes. Evidence suggests that such disparities in screening uptake contribute directly to later stage diagnoses and poorer survival among these populations, thereby widening existing inequalities in cancer outcomes (von Wagner et al., 2009).

Interventions to improve bowel cancer screening uptake have been implemented across many healthcare systems like within the NHS in the UK and across the US, to address these inequalities. Strategies have included enhanced invitation letters, reminders, GP endorsements, simplified test kits, telephone outreach, and targeted educational programmes. However, systematic reviews show that although such interventions produce modest improvements in uptake, they do not consistently reduce inequalities between socioeconomic or ethnic groups (Goodwin et al., 2019; Myers et al., 2020; Tsipa et al., 2020). A key limitation is that many interventions are not explicitly grounded in behavioural theory, reducing their ability to target the psychological and social determinants of screening behaviour. Moreover, although interventions have been evaluated in countries such as the UK, United States, Australia, and the Netherlands, findings are rarely integrated to build a universal understanding of what works, for whom, and in which contexts. As a result, intervention design often remains population-level and generic, with limited attention to how effectiveness may differ across cultural, linguistic, or healthcare system contexts, or whether mechanisms of change vary across subgroups.

A growing body of evidence suggests that intervention effectiveness varies between population groups. For example, knowledge-based interventions have been found to improve uptake among lower SES groups, where awareness and understanding of screening are often limited, but appear less relevant in affluent groups (Lasser et al., 2008). Similarly, men from deprived backgrounds have been found to exhibit particularly low participation, highlighting the importance of considering the interaction between SES and gender (Gascoyne et al., 2023). Yet ethnicity, despite being a consistently reported predictor of non-participation, has rarely been examined as a moderator of intervention effectiveness in previous systematic reviews.

The persistence of low and unequal participation highlights the need for an updated synthesis of the international evidence base. Building on previous work, this review will evaluate not only the overall effectiveness of interventions but also whether these effects differ by participant characteristics, particularly ethnicity. Given the substantial volume of research conducted in recent years, including studies published up to February 2025, this review provides an opportunity to deliver the most comprehensive and up-to-date assessment of interventions to increase bowel cancer screening uptake and to explore how effectiveness varies across population subgroups.

6.2.2 Intervention characteristics and effectiveness

Interventions to improve bowel cancer screening uptake have been delivered in a variety of ways, ranging from relatively passive strategies (e.g., mailed invitations) to intensive, personalized approaches (e.g., navigation support). A substantial body of evidence suggests that intervention characteristics including delivery mode, intensity, tailoring, theoretical basis, and the application of Behaviour Change Techniques (BCTs), defined as the active components designed to change behaviour (Michie et al., 2013) play a crucial role in shaping effectiveness. As Tsipa et al. (2020) emphasize, failure to account for these features limits generalisability of findings across groups.

Delivery mode is a key dimension of intervention effectiveness. Passive methods, such as mailed reminders or informational leaflets, are scalable but may not engage underserved or hard-to-reach populations. Active methods such as telephone outreach, patient navigation, or community health worker facilitation often produce stronger effects on screening behaviour, especially within minority or disadvantaged populations (Kava et al., 2025). In the United States, community health worker–led interventions have been shown to significantly improve screening uptake among racial and ethnic minority groups, especially when embedded in culturally appropriate frameworks (Rana et al., 2024).

Format and intensity of the intervention matters as well. Single-component interventions (e.g., reminders alone) tend to produce modest gains, whereas multicomponent strategies that integrate multiple approaches (e.g., education + reminders + navigation) yield more substantial effects (Community Guide / CPSTF). For example, combining strategies to increase community demand and access has led to median improvements in screening uptake of over 11 percentage points, whereas interventions using all three CPSTF strategic categories (demand, access, provider delivery) achieved median increases of over 24 points (Community Preventive Services Task Force [CPSTF], 2016).

Tailoring and targeting are critical for reaching diverse groups. General population interventions may overlook barriers specific to ethnic minority communities, such as language, health literacy, cultural beliefs, or trust in institutions. Tailored materials (e.g., translated documents, culturally framed messages) and community-engaged design can be more acceptable and effective (Watson et al., 2023). In the TEMPO trial, co-designed behavioural interventions to improve uptake of the faecal immunochemical test (FIT) showed promising increases across varied population subgroups, highlighting the advantages of participant-centred design and tailoring (Robb et al., 2025).

The use of theory in intervention design is another important moderator. Interventions grounded in psychological models (e.g., Health Belief Model, Protection Motivation Theory, Theory of Planned Behaviour) are better positioned to target constructs such as perceived susceptibility, benefits, and self-efficacy. However, many interventions remain atheoretical or only loosely theory-informed (Myers et al., 2020). Incorporating theoretical frameworks also enables testing of mediators and mechanisms of change, thus facilitating translation across contexts.

Finally, the careful selection and deployment of behaviour change techniques (BCTs) such as reminders, prompts, planning, feedback, modelling, and commitment devices can enhance intervention potency; for instance, a recent factorial trial explored various BCTs to reduce colonoscopy barriers and identified planning and prompts as effective components (Kerrison et al., 2025). Similarly, behavioural economics "nudges" (e.g., default opt-outs, choice architecture, social norms cues) have shown promise in increasing screening uptake, though effects are heterogeneous and context-dependent (Ahadinezhad et al., 2024).

Together, these intervention characteristics like delivery mode, format and intensity, tailoring, theoretical grounding, and BCT selection are essential moderators of effectiveness. A systematic examination of how these characteristics intersect with participant-level factors (especially ethnicity) will enhance our capacity to identify interventions most likely to reduce inequalities in bowel cancer screening uptake.

6.2.3 Participant Characteristics

Beyond intervention design, participant characteristics play a critical role in determining whether strategies to increase bowel cancer screening are successful. Research consistently shows that uptake varies across sociodemographic and psychosocial dimensions, yet most previous systematic reviews have assessed overall intervention effects without examining whether effectiveness differs by subgroup (Tsipa et al., 2020). In the present review, participant characteristics are considered key moderators of intervention outcomes, with particular emphasis on ethnicity due to substantial gaps in literature.

Ethnicity has emerged as one of the strongest predictors of variation in screening uptake. Evidence from the UK demonstrates that participation is markedly lower among South Asian, Black, and other minority ethnic groups compared to White populations (Robb et al., 2008; Szczepura et al., 2008). These disparities persist even after accounting for socioeconomic status, suggesting that ethnicity is an independent predictor of screening behaviour (von Wagner et al., 2009). International evidence also highlights these patterns: in the United

States, African American and Hispanic groups have historically reported lower rates of colorectal screening, while Asian immigrants often face unique barriers such as language and cultural stigma (Liang et al., 2016; Siegel et al., 2017). Despite these consistent findings, few intervention reviews have assessed whether strategies to improve uptake are equally effective across ethnic groups. This represents a major gap in the evidence base that this review seeks to address.

Socioeconomic status (SES) is another important moderator. Participation is substantially lower in disadvantaged groups, reflecting barriers such as reduced health literacy, limited access to healthcare, and competing life demands (Palmer et al., 2014; von Wagner et al., 2011). While interventions can improve uptake in low-SES groups, evidence suggests they often do not fully close the gap (Goodwin et al., 2019). Recent trials indicate that tailoring interventions to literacy levels or simplifying test kits may reduce inequalities (Gascoyne et al., 2023; Lasser et al., 2008).

Gender and age differences have also been observed. Men are less likely than women to participate in screening, particularly within deprived groups (Gascoyne et al., 2023), while older adults, who are most at risk, sometimes face additional barriers like accessibility issues related to comorbidities and functional limitations (Power et al., 2009). These patterns suggest that interventions may need to be adapted to accommodate demographic variations.

Finally, psychosocial predictors such as intention, attitudes, subjective norms, and self-efficacy strongly influence screening behaviour. Previous chapters of this thesis demonstrated that these constructs are among the most consistent predictors of uptake. Interventions that directly target these psychological mechanisms may therefore be particularly effective. However, the extent to which psychosocial determinants mediate or moderate intervention effects across different groups remains under-examined (Myers et al., 2020).

Taken together, participant characteristics including ethnicity, SES, gender, age, and psychosocial variables are crucial moderators of intervention effectiveness. Systematically assessing these moderators will allow this review to provide a more nuanced understanding of how interventions can be optimised to reduce disparities in bowel cancer screening uptake

6.2.4 Methodological Characteristics

In addition to intervention and participant characteristics, methodological factors can also influence estimates of intervention effectiveness. Differences in study design, sampling, and reporting practices may contribute to the considerable heterogeneity observed across trials of bowel cancer screening interventions. Understanding these sources of variation is essential to evaluating the strength and reliability of the evidence base.

Study design is a central methodological characteristic. Randomised controlled trials (RCTs) remain the gold standard for assessing intervention effectiveness due to their ability to minimise selection bias and confounding. However, a substantial number of studies in this area employ quasi-experimental or observational designs. While such studies expand the evidence base, they may overestimate effects due to weaker internal validity (Higgins et al., 2011). Reviews of cancer screening interventions have found that effect sizes can differ between RCTs and non-RCTs, suggesting that study design should be considered as a potential moderator (Myers et al., 2020).

Sample size and setting also affect the robustness of findings. Large-scale national evaluations may provide highly generalisable evidence but risk masking subgroup differences, whereas smaller community-based trials may capture nuanced effects in specific populations but lack statistical power to detect modest intervention impacts. The geographical context of trials, whether conducted in universal healthcare systems such as the NHS, or in insurance-based systems such as the US, may further shape outcomes, particularly given structural differences in access and cost (Zauber et al., 2015).

Risk of bias is another critical concern. Factors such as inadequate blinding, incomplete outcome data, and selective reporting can undermine confidence in findings (Higgins et al., 2011). Prior reviews have highlighted variability in study quality, with lower-quality studies sometimes reporting larger effects (Goodwin et al., 2019).

Finally, publication year is an important methodological factor. Intervention trials have evolved over time, with earlier studies often focusing on FOBt uptake and more recent studies evaluating FIT-based strategies or digital innovations. By including trials published up to February 2025, the present review provides the most up-to-date synthesis, capturing contemporary approaches that may differ in effectiveness from older interventions.

Together, these methodological characteristics like study design, sample size, setting, risk of bias, and year of publication, represent important moderators of intervention outcomes and will be systematically examined within this review.

6.2.5 Gaps in Existing Reviews

Although several systematic reviews and meta-analyses have evaluated interventions to improve bowel cancer screening uptake, important limitations remain. Previous reviews have primarily focused on overall intervention effectiveness, with comparatively little attention paid to subgroup differences or moderators of outcomes. This has limited understanding of whether interventions work equally well across diverse populations.

For example, Goodwin et al. (2019) reviewed interventions to promote bowel cancer screening and found modest overall effects, but the review did not conduct detailed subgroup analyses by participant characteristics such as ethnicity, socioeconomic status, or gender. Similarly, Myers, Goodwin, March, and Dunn (2020) provided a comprehensive synthesis of patient-level interventions but concluded that there was insufficient evidence to determine how intervention effectiveness varies across sociodemographic groups. Both reviews acknowledged the importance of addressing disparities but lacked the necessary data or analytic focus to examine these questions in detail.

Tsipa et al. (2020) provided one of the most comprehensive reviews to date, synthesising 102 intervention studies and conducting moderator analyses by socioeconomic status. This review demonstrated that interventions can be particularly beneficial in reducing inequalities for low-SES populations. However, ethnicity was not examined as a moderator, despite consistent evidence that minority ethnic groups are among the least likely to participate in bowel cancer screening (Robb et al., 2008; Szczepura et al., 2008). As a result, the effectiveness of interventions for different ethnic groups remains unclear.

Another limitation of existing reviews is their temporal scope. Most were conducted prior to 2020 and therefore do not include the large number of randomised controlled trials (RCTs) published in the past five years. These newer studies often evaluate contemporary approaches such as FIT-based screening, digital and mobile health strategies, and culturally tailored interventions, which may show different patterns of effectiveness than earlier FOBt-focused trials. By updating the evidence base to February 2025 and incorporating these recent RCTs, the present review will provide the most current synthesis of intervention effectiveness.

Taken together, the limitations of prior reviews highlight the need for an updated and focused analysis. This review builds on earlier work by including the latest trials and explicitly testing whether intervention effects vary by participant characteristics most notably ethnicity in addition to socioeconomic status, gender, and psychosocial predictors.

6.2.6 Study Aims

The present systematic review and meta-analysis aims to provide a comprehensive and up-to-date synthesis of interventions designed to increase bowel cancer screening participation. Building on previous reviews, which have largely examined overall intervention effectiveness without sufficient attention to subgroup differences, this review focuses on whether intervention impact varies across participant characteristics, particularly ethnicity.

In addition, this review will evaluate other potential moderators of intervention effectiveness, including socioeconomic status, gender, and age, as well as psychosocial variables such as intention, self-efficacy, attitudes, and perceived benefits. By testing these moderators, the review will contribute to a more nuanced understanding of the factors that drive disparities in screening uptake.

To achieve this, the review will synthesise evidence from all eligible trials published up to February 2025. Intervention characteristics (e.g., delivery mode, tailoring, theoretical foundation, behaviour change techniques) and methodological features will also be examined as moderators. Together, these analyses will provide evidence to guide the design of interventions that are both effective and equitable, with the ultimate goal of reducing disparities in bowel cancer screening participation and boosting screening uptake.

6.3 Methods

6.3.1 Protocol Registration

The protocol for this systematic review and meta-analysis was pre-registered with the International Prospective Register of Systematic Reviews (PROSPERO) database (registration number: 2023, CRD42023398358). Details of the protocol can be viewed in Appendix D. 6.1.

6.3.2 Search Strategy

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (refer to Figure 6.1). A comprehensive search was conducted across five electronic databases: MEDLINE (1950–present), EMBASE (1947–present), PsycINFO (1806–present), Web of Science (1999–present), and the Cochrane Library. Searches were limited to peer-reviewed journal articles published in English.

The search strategy was structured using the PICOS framework (see Figure 6.2), with inclusion criteria relating to participants, interventions, comparisons, outcomes, and study design. Search terms (refer to Appendix D. 6.3) were developed using both keywords and controlled vocabulary (MeSH terms), combining terms related to bowel or colorectal cancer AND screening AND intervention (e.g., “bowel cancer,” “colorectal screening,” “faecal immunochemical test,” “uptake promotion,” “early detection,” “behavioural intervention”). The final search syntax was adapted for each database’s interface and supplemented with citation tracking and reference list searches. The search strategy was informed by previous systematic reviews of cancer screening interventions (Baron et al., 2008; Holden et al., 2010; Tsipa et al., 2020) but was expanded to capture studies conducted across multiple countries and ethnic populations, including those comparing outcomes between White and non-White groups or reporting disaggregated ethnicity data.

An initial search was conducted between October 2023 and October 2024, with an update in February 2025 to ensure inclusion of the most recent evidence. In total, 18,391 potentially relevant records were identified across databases. After removing duplicates, 3,415 unique records were screened at title and abstract level. 305 full-text articles were reviewed for eligibility, and 119 studies met the inclusion criteria for quantitative synthesis (see Figure 6.1 for PRISMA flow diagram).

The search was restricted to English-language studies and articles published in peer-reviewed journals. The present meta-analysis only included studies that adopted a RCT study design, this was a primary focus at the start of the review and was chosen as the study design in the review search strategy. The decision to restrict to RCTs only was justified by two main reasons: firstly, it has been argued that meta-analyses seeking to examine the effects of interventions should be limited to RCTs because the RCT design eliminates the influence of confounding variables and minimises the threat of selection bias due to random allocation of participants to study condition, which is increased in non-randomised studies of interventions (NRSIs) (Odgaard-Jensen et al., 2011, Tsipa et al., 2020).Within the context of cancer screening and evaluating healthcare interventions, RCTs are widely accepted as the ideal research design for obtaining unbiased estimates of intervention effects. Secondly, the inclusion of other study designs would have been necessary had there been a lack of appropriate evidence based RCTs identified through the database search that addressed the research question of interest which was not the case here.

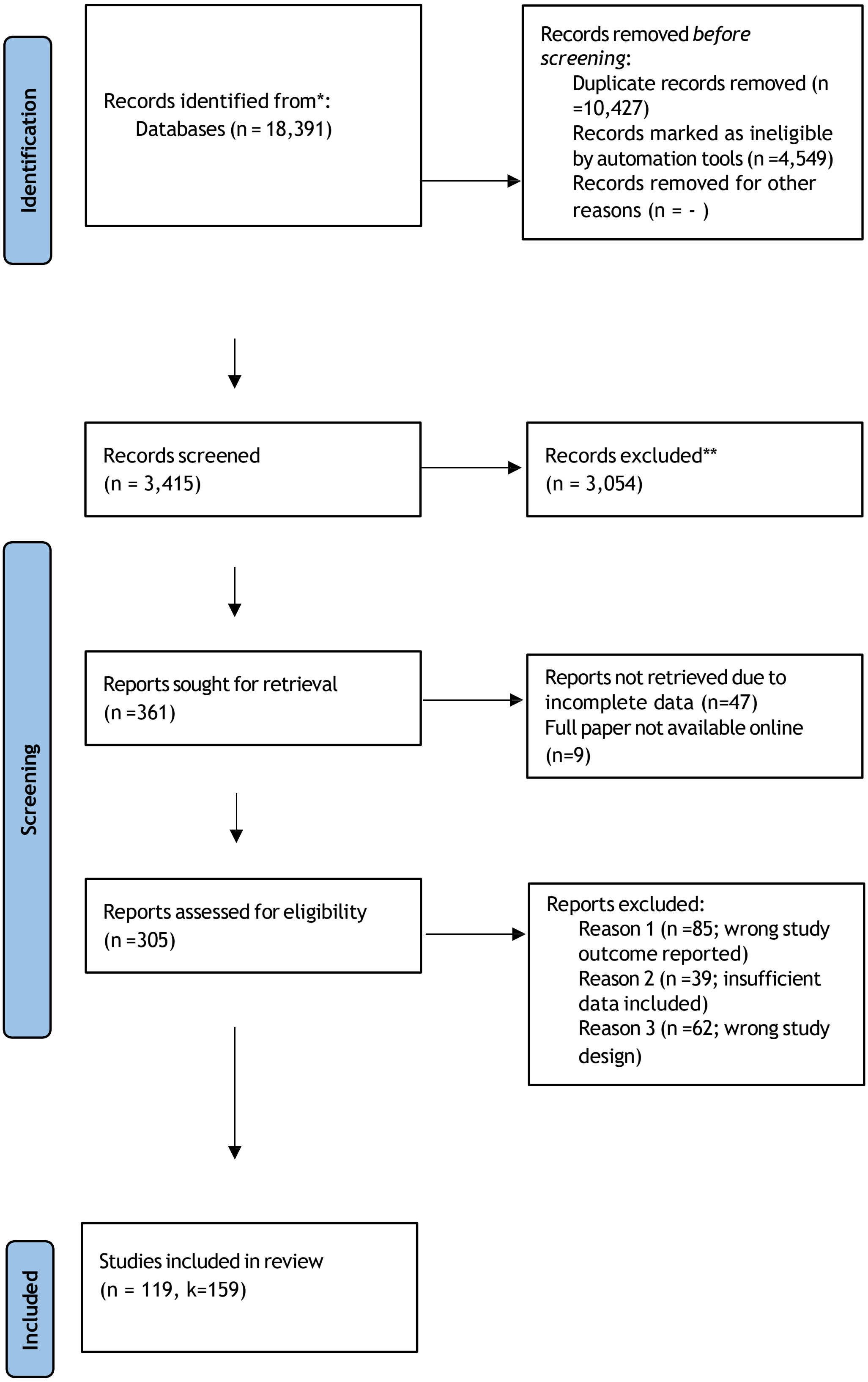
Identification
Records identified from*:
Databases (n = 18,391)
Records removed *before screening*:
Duplicate records removed (n =10,427)
Records marked as ineligible by automation tools (n =4,549)
Records removed for other reasons (n = -)
Screening
Records screened
(n = 3,415)
Records excluded**
(n = 3,054)
Reports sought for retrieval
(n =361)
Reports not retrieved due to incomplete data (n=47)
Full paper not available online (n=9)
Reports assessed for eligibility
(n =305)
Reports excluded:
Reason 1 (n =85; wrong study outcome reported)
Reason 2 (n =39; insufficient data included)
Reason 3 (n =62; wrong study design)
Included
Studies included in review
(n = 119, k=159)

Figure 6.1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

6.3.3 Inclusion Criteria

Studies were eligible for inclusion if they evaluated an intervention explicitly designed to increase bowel cancer screening uptake. Eligible studies were required to report quantitative outcome data, specifically screening participation rates following the intervention, such as test kit return or attendance for colonoscopy or FIT/gFOBt screening. Interventions and comparison conditions had to be clearly described to allow for calculation of effect sizes. Studies were included if participants were aged 40 years or older at the point of recruitment and had no prior diagnosis of bowel cancer. Only unique data were retained, ensuring that no duplicated samples or overlapping publications were included. All studies were required to be published in peer-reviewed journals and available in the English language.

The search strategy also incorporated updated and contemporary intervention terms, reflecting recent technological and practice-based developments in screening promotion. For example, search strings included modern strategies such as electronic portal invitations, SMS reminders, GP-endorsed letters, simplified home collection kits, and digital follow-up mechanisms, alongside traditional communication and outreach approaches. Studies were included only if the intervention was explicitly labelled as the independent variable and screening uptake was the primary quantitative outcome measure post-intervention. Only trials in which participants were randomly allocated to an intervention or control condition were included to ensure methodological rigour and minimise potential bias. To ensure consistency of outcome measurement, studies were included only if they reported post-intervention screening uptake quantitatively for both the intervention and control groups, allowing for direct computation of odds ratios.

Interventions were excluded if they focused on rescreening, follow-up after a positive test, or diagnostic adherence, as the present analysis was limited to interventions promoting initial participation in bowel cancer screening programmes. Studies were also excluded if they did not provide explicit post-intervention uptake rates or if rates were reported in aggregate without distinction between study arms. This ensured that all included studies contributed clearly interpretable data on the effect of the intervention relative to a control or standard invitation condition. All included trials were published in peer-reviewed journals and written in English. Duplicate datasets, overlapping samples, conference abstracts, dissertations, and protocols were excluded to maintain data integrity and quality. Studies were also required to report unique quantitative outcome data on screening participation; purely descriptive or qualitative reports were not eligible.

The search strategy was deliberately broad, incorporating updated intervention terminology to capture both traditional and contemporary approaches to promoting screening. This included search terms for electronic reminders, digital portals, GP-endorsed invitations, simplified home testing kits, and community outreach interventions, alongside established terms used in earlier reviews such as Tsipa et al. (2020). Unlike Tsipa et al., who restricted their review to trials reporting overall intervention effectiveness, the present review expanded eligibility to include studies involving ethnically diverse samples to enable examination of equity in intervention impact. As a result, 38 additional RCTs published after 2016 were identified through the updated search, and a further 14 earlier trials not included in Tsipa et al.'s review were located due to broader ethnicity-related search terms, yielding 52 new eligible studies in total. Conversely, 19 studies included by Tsipa et al. were excluded here because they neither reported ethnicity nor included ethnically diverse participants and therefore could not contribute to analyses of intervention reach or subgroup effects. Consistent with this equity focus, trials were included if they (a) reported ethnicity-specific results (e.g., White vs Non-White), (b) included ethnically mixed samples even when outcomes were not stratified, or (c) specifically targeted ethnic minority populations. When separate effects were reported for different ethnic groups within the same trial, these were coded as independent contrasts. Ethnicity classifications were harmonised under a standardised White versus Non-White framework to support comparability while retaining original study descriptors.

All decisions regarding study eligibility were made independently by two members of the review team. Any discrepancies or disagreements about inclusion were resolved through discussion and consensus, with a third reviewer consulted when necessary. Reasons for exclusion at the full-text stage were documented to ensure transparency. Conference abstracts, dissertations, posters, protocols, guidelines, and think-pieces were excluded, as these did not provide sufficient methodological detail or peer-reviewed data suitable for synthesis. The full texts of the eligible studies were retrieved and assessed for eligibility. The author extracted relevant information for the entirety of the studies and a second reviewer independently assessed 10% of the full text studies for inclusion in the review. Discrepancies were resolved through discussion.

While the inclusion criteria were broadly consistent with those used in previous prominent meta-analyses of bowel cancer screening interventions (e.g., Tsipa et al., 2020), the present review incorporated several important refinements. First, it was restricted to randomised controlled trials that reported explicit, quantitative post-intervention screening rates for both intervention and control arms, ensuring effect sizes could be reliably reconstructed and compared across studies. Second, only interventions targeting first-time screening participation were included, whereas previous reviews often also encompassed follow-up or repeat screening. Finally, the current review extended inclusion to studies involving ethnically diverse populations, including those that did not provide stratified analyses but nonetheless contributed to understanding intervention reach and equity. In addition, updated and broader search terminology captured more contemporary intervention modalities, such as electronic reminders, portal-based invitations, and simplified home testing kits, reflecting advances in screening promotion strategies since earlier meta-analyses. Collectively, these refinements allowed the current review to maintain methodological rigour while extending the relevance and inclusivity of the evidence base.

PICOS Element	**Inclusion Criteria**
Population (P)	Participants aged 40 years or older at the point of randomisation; participants with no personal history of bowel cancer; studies including participants from across different groups.
Intervention (I)	Studies quantitatively evaluated interventions designed to increase bowel cancer screening participation.

Comparator (C)	Appropriate comparison groups were included in the study design (e.g., control groups or alternative intervention conditions).
Outcomes (O)	Studies reported outcome data quantitatively, measuring the effectiveness of interventions on screening participation.
Study Design (S)	Studies followed a randomised controlled trial (RCT) design with participants randomly allocated to conditions; studies were published in peer-reviewed journals; data presented were unique and not duplicate publications.

Figure 6.2 PICOS Framework

6.3.4 Data Extraction

Quantitative information from each eligible study was extracted using a standardised, pre-piloted data extraction form developed in accordance with Cochrane guidance for intervention reviews (see Appendix D 6.4). The form was adapted to capture detailed information specific to the aims of the present meta-analysis. Extracted data included study-level details (authors, year of publication, country, and healthcare context), participant characteristics (mean age, percentage female, and ethnicity distribution), and methodological information (study design, sample size, and outcome measures).

For each trial, the intervention and control conditions were extracted in full, including descriptions of intervention content, duration, delivery mode, and behavioural targets. Intervention components were coded according to a harmonised taxonomy derived from the Behaviour Change Technique (BCT) framework described in Tsipa et al. (2021). Closely related intervention labels were collapsed into three principal categories: adding objects to the environment (e.g., mailed kits or test materials), information about consequences (risk or benefit messaging), and social support (unspecified). Additional intervention characteristics were systematically coded:

- Intervention Setting (research staff, clinically trained, non-clinically trained/lay);
- Contact Type (in-person, remote [mail/phone/text/web]);
- Mode of Delivery (individual vs group);
- Materials Used (paper, telephone, electronic/web); and
- Use of Reminders (present vs absent).

Where multiple arms were reported, each intervention arm was coded as an independent contrast against the common control group, ensuring statistical independence across 159 contrasts derived from 119 unique RCTs.

Screening outcomes were extracted quantitatively, with separate post-intervention screening rates recorded for the intervention and control groups to enable accurate computation of odds ratios (*ORs*) and 95% confidence intervals. Studies reporting only aggregate or incomplete rates were excluded at the eligibility stage. Outcomes were further coded as objective (e.g., verified medical records or administrative data) or self-reported (e.g., participant recall).

Moderator variables were also systematically coded to support subgroup and meta-regression analyses. Participant-level moderators included mean age, percentage of female participants, and percentage of White versus Non-White participants (by arm where available). Ethnicity data were extracted exactly as reported in each study and subsequently harmonised into a binary framework (White vs Non-White) to ensure comparability across diverse reporting systems. Where studies provided separate quantitative estimates of intervention effectiveness for White and Non-White groups, these data were independently extracted and included as separate contrasts in the ethnicity-specific meta-analysis. In contrast, studies that included ethnically diverse samples but did not stratify results by group were coded as “mixed ethnicity.” This harmonised approach allowed ethnicity to be examined both as a primary analytical factor and as a moderator in subgroup analyses, ensuring that observed differences in intervention effectiveness could be meaningfully interpreted across populations.

Methodological moderators included outcome type (objective vs self-report) and risk of bias, assessed using the Cochrane Collaboration tool-RoB 2 (Higgins et al., 2011) and coded as low, unclear, or high risk. Consistent with previous reviews of bowel cancer screening interventions (e.g. Tsipa, 2018). Each study was independently evaluated across six standard domains: (1) random sequence generation (selection bias), (2) allocation concealment (selection bias), (3) blinding of participants and personnel (performance bias), (4) blinding of outcome assessment (detection bias), (5) incomplete outcome data (attrition bias), and (6) selective reporting (reporting bias). In line with recent meta-analytic practice, a seventh indicator was included to capture whether studies reported an intention-to-treat (ITT) analysis, as this represents a key marker of methodological rigour in screening trials.

Each domain was rated as low risk, unclear risk, or high risk of bias based on the adequacy and transparency of reporting. Studies were classified as low risk of bias if they met criteria and provided sufficient detail across all domains. A judgement of unclear risk was assigned where reporting was insufficient to determine study quality in one or more domains. Studies were judged high risk of bias where procedures were either inappropriate or not implemented consistently (e.g. inadequate randomisation methods, high attrition without appropriate handling, or failure to blind outcome assessors where feasible).

A summary risk of bias judgement was derived for each study and subsequently used as a methodological moderator variable in subgroup and meta-regression analyses (coded as low vs unclear/high risk). Risk of bias assessment was completed by the lead reviewer (SS), with 10% of studies independently checked by a second reviewer. Agreement was high (k = .91), and disagreements were resolved through discussion. Details are enclosed within Appendix D. 6.2.

Data extraction and coding were initially performed by SS using the standardised form, with 10% of studies independently extracted by a second reviewer (LT). Inter-rater agreement was high (98%), and discrepancies were resolved through discussion, achieving full consensus. Where details were missing or ambiguous, study authors were contacted for clarification. This comprehensive and transparent process ensured consistency, accuracy, and reproducibility of all extracted data.

6.3.5 Data Analysis

All statistical analyses were conducted using Comprehensive Meta-Analysis (CMA) software, version 4 (Borenstein et al., 2021). Odds ratios (*ORs*) with 95% confidence intervals (*CIs*) were used as the common effect size metric. Where necessary, data were converted to *log(OR)* and corresponding standard errors to enable consistent pooling across studies. All analyses employed random-effects models (DerSimonian–Laird estimator), which account for both within- and between-study variance, acknowledging that true intervention effects are expected to vary across populations, contexts, and implementation methods. Fixed-effect models were also calculated for comparison.

For each eligible RCT, the primary outcome was participation in bowel cancer screening, measured post-intervention through either objective verification (e.g., medical or registry records) or self-report. Where multiple follow-up time points were reported, the first post-intervention assessment was extracted to maximise comparability. For multi-arm RCTs, each intervention arm was coded as a separate contrast against the common control group, following Cochrane recommendations, to ensure statistical independence without double-counting.

Statistical heterogeneity was assessed using Cochran's Q test, the I^2 statistic, and the between-study variance τ^2. Conventional thresholds were applied, with I^2 values of 25%, 50%, and 75% interpreted as low, moderate, and high heterogeneity, respectively (Higgins et al., 2003). Prediction intervals were computed to reflect the expected range of true effects in new studies.

Publication bias was evaluated using funnel plots, Egger's regression intercept, and the trim-and-fill procedure. Egger's test results were reported for the overall analysis and for key subgroups (intervention type, delivery setting, contact type, materials used, and reminders). Significant intercepts ($p < .05$) were interpreted as potential small-study effects.

Sensitivity analyses were conducted to examine the robustness of pooled estimates. These included: (a) leave-one-out analyses, in which each contrast was sequentially removed to assess influence on the overall *OR*; (b) outlier-trimmed models excluding the most extreme 2.5% of contrasts; and (c) analyses restricted to studies with low or unclear risk of bias. Across these tests, pooled effects remained stable, confirming the robustness of findings.

To explore variability in intervention effectiveness, subgroup meta-analyses were conducted for categorical moderators, with $Q_{between}$ (χ^2) tests evaluating differences across levels of each variable. The following intervention characteristics were analysed as categorical moderators: intervention type, intervention setting, contact type, mode of delivery, materials used, and use of reminders. Additional moderator analyses examined participant-level factors (age, gender, and ethnicity) and methodological features (outcome type, risk of bias).

Finally, to test for ethnic differences in intervention effectiveness, ethnicity-stratified subgroup meta-analyses were conducted comparing White vs Non-White participants, followed by Wald χ^2 interaction tests to evaluate Ethnicity × Moderator effects (e.g., whether intervention type or delivery mode showed differential impact by ethnicity).

6.4 Results

6.4.1 Study Characteristics

A total of 18,391 potentially relevant records were identified through database searches. After deduplication, 3,415 unique records were screened at title/abstract. 305 full texts were assessed, 186 were excluded (e.g., wrong population/outcome/design), and 119 studies were included (See Appendix D. 6.5), contributing 159 contrasts of intervention versus control on bowel cancer screening uptake. The study selection process followed PRISMA guidelines (Page et al., 2021), and a PRISMA flowchart was produced to document the numbers of studies identified, screened, excluded, and included at each stage of the review. Across the included evidence, the estimated combined sample comprised =1,085,602 participants (to avoid double-counting multi-arm trials, this estimate sums unique intervention arm *Ns* plus the largest control *N* within each study): Intervention = 558,052; Control = 527,550. Samples were highly variable, with several large, program-embedded randomized trials inflating the average (mean = 9,123), while the median = 856 indicates many mid-sized community and primary-care trials alongside fewer very large rollouts.

The geographical distribution was dominated by the USA (k = 94), spanning community clinics, integrated systems, and Medicaid/insured populations (e.g., Aragones et al., 2010; Preston, 2017; Saini et al., 2023). The UK (k = 7) contributed studies embedded in the NHS and general practice settings (e.g., Allgood et al., 2016; Hewitson, Ward, Heneghan, Halloran, & Mant, 2011; Hirst et al., 2017). Additional contributions were from *Canada (k = 3; Cuaresma, 2018; Ritvo et al., 2015; Tinmouth, 2014), and from *Australia (k = 2; Cole et al., 2007; Cole, Young, Byrne, Guy, & Morcom, 2002). Smaller but informative bodies of work came from *Israel (k = 2; Hagoel, 2016; Neter et al., 2014), *Iran (k = 2; Lemon, 2013; Salimzadeh, 2013), and *Spain (k = 2; Gimeno-Garcia et al., 2009; Guiriguet et al., 2016).

Single-study contributions were identified for *France (*k* = 1; Barthe et al., 2015), *Germany (*k* = 1; Gruner, 2020), *Italy (*k* = 1; Selva, 2019), *Netherlands (*k* = 1; van Roon, 2011), *Poland (*k* = 1; Boguradzka et al., 2014), *Singapore (*k* = 1; Ha et al., 2014), and *Turkey (*k* = 1; Temucin & Nahcivan, 2018). This spread captures diverse delivery systems and population contexts, though it remains weighted toward high-income, U.S.-based settings.

Designs consisted of randomized or cluster-randomized trials. Interventions ranged from mailed kits and invitation strategies to multi-component, theory-informed packages (often incorporating reminders), against usual care or standard invitation controls. Overall, the sample frames largely aligned with screening eligibility (50–74 years), and sex distribution was approximately balanced across arms where reported.

Intervention features were coded using the Behaviour Change Technique (BCT) taxonomy described in Tsipa et al. (2023), ensuring consistency in the identification of behavioural content and delivery parameters. Each included study was coded across six domains: intervention type, intervention setting, contact type, mode of delivery, materials used, and use of reminders. Intervention Type was categorised based on the dominant BCT observed. The most frequently applied technique was “Adding objects to the environment” (*k* = 74), typically reflecting mailed screening kits, reminder packs, or environmental prompts. This was followed by “Information about health consequences” (*k* = 62), representing interventions that emphasised perceived severity and benefits of screening, and “Social support (unspecified)” (*k* = 23), which involved peer or lay navigator assistance.

Intervention Setting referred to who delivered the intervention. Most were implemented by research staff (*k* = 96 when combining variations in labelling), followed by non-clinically trained health staff (*k* = 42), and clinically trained staff such as nurses or physicians (*k* = 21). This range highlights the diversity of implementers, from controlled research projects to pragmatic community and primary-care trials. Contact Type denoted the mode of contact between participants and intervention agents. Most interventions were remote (*k* = 111), involving mailed invitations, electronic messages, or telephone contacts. Fewer were delivered in person (*k* = 48), typically via face-to-face consultations or outreach sessions.

Mode of Delivery captured whether interventions were targeted individually or within groups. The large majority were individual-based (*k* = 138, after harmonising label variants such as “individual” vs “Individual”), while group-based formats were less common ($k = 21$), often used in community education or peer-support sessions. Materials Used described the primary communication medium. Paper-based materials dominated ($k = 91$), reflecting postal leaflets, letters, and brochures. Telephone-based approaches were also frequent ($k = 35$), followed by electronic materials such as emails or web links ($k = 33$).

Finally, Use of Reminders was coded dichotomously. Most contrasts involved an explicit reminder component ($k = 103$), whereas 56 contrasts had no reminder element. Reminder mechanisms (letters, calls, or texts) were frequently integrated within multi-component designs and often formed the active comparator against standard invitation procedures. Together, these coding dimensions provide a structured overview of how intervention content, delivery, and context varied across studies, facilitating subsequent moderator and subgroup analyses.

6.4.2 Syntheses of Overall Intervention Effectiveness

A comprehensive meta-analysis was conducted across 119 unique studies contributing 159 contrasts comparing intervention and control conditions on bowel cancer screening uptake. A random-effects model (DerSimonian–Laird) was applied to estimate the average intervention effect while accounting for between-study variability. The pooled estimate indicated that interventions significantly increased screening uptake relative to controls, $OR = 1.46$, 95% CI [1.40, 1.53], $p < .001$, representing a moderate overall effect in favour of the intervention group. For comparison, a fixed-effect model, which weights larger, more precise studies more heavily, produced a smaller but still highly significant estimate, $OR = 1.16$, 95% CI [1.15, 1.17], $p < .001$, reflecting the influence of high-precision trials with smaller relative effects.

Substantial between-study heterogeneity was observed, $Q(158) = 2719.51$, $p < .001$, with an $I^2 = 94.19\%$ and $\tau^2 = 0.0542$, indicating that approximately 94% of the observed variance reflects real differences in intervention effects rather than sampling error. This level of heterogeneity justifies the use of random-effects modelling and further exploration through moderator and subgroup analyses. Refer to Table 6.1 for a quick overview.

Publication Bias and Sensitivity

Potential small-study effects were examined using Egger’s regression test, which yielded a significant intercept ($b_0 = 2.43$, $p < .001$), suggesting possible publication bias or selective reporting favouring positive results. However, results of the leave-one-out sensitivity analysis demonstrated the pooled effect was robust: excluding any single contrast produced only minimal variation in the overall estimate (pooled *OR* range = 1.44–1.47).

Summary

Taken together, these findings demonstrate that behavioural and structural interventions significantly improve bowel cancer screening uptake across diverse populations and settings. Although evidence of small-study bias was detected, sensitivity checks confirmed the stability of the pooled effect, underscoring the robustness of the overall intervention impact.

Table 6.1 Overall pooled intervention effect (k = 159)

Model	*K*	*K (unique)*	*OR*	*95% CI*	*p*	*Q(df)*	*I^2 (%)*	*τ^2*	*95% PI*
Fixed-effects	159	119	1.16	[1.15, 1.17]	< .001	2719.51 (158)	94.19	0.0542	—
Random-effects (DL)	159	119	1.46	[1.40, 1.53]	< .001	2719.51 (158)	94.19	0.0542	[0.90, 2.36]

Note. Values are based on a random- and fixed-effects meta-analysis including 159 contrasts from 119 studies. *OR* = odds ratio; *CI* = confidence interval; *PI* = prediction interval; *DL* = DerSimonian–Laird; *df* = degrees of freedom.

6.4.3 Subgroup analyses (moderators)

Random-effects subgroup analyses were performed for categorical intervention characteristics, with between-group differences tested using $Q_{between}$ (χ^2). **Intervention type** emerged as a significant moderator, $Q_{between}$ (2) = 22.18, $p < .001$. Interventions that added tangible objects to the environment, such as mailing fecal test kits or providing home collection materials, produced a strong average effect (*OR* = 1.48 [1.38, 1.58]; *k* = 74). Social-support-based interventions were similarly effective (*OR* = 1.58 [1.36, 1.83]; *k* = 23), whereas interventions focused primarily on providing information about health consequences showed smaller but still significant effects (*OR* = 1.41 [1.31, 1.52]; *k* = 62). Thus, interventions that facilitated direct behavioural action or encouraged social accountability tended to outperform those relying solely on informational cues.

Intervention Setting also significantly moderated outcomes, $Q_{between}$ (2) = 15.33, *p* < .001. Programmes delivered by research staff achieved the highest overall effect (*OR* = 1.48 [1.39, 1.57]; *k* = 96), followed by those implemented by non-clinically trained health staff (*OR* = 1.44 [1.31, 1.57]; *k* = 42) and clinically trained professionals (*OR* = 1.44 [1.27, 1.63]; *k* = 21). Although differences were modest, research-staff-led interventions appeared slightly more efficacious, likely reflecting greater protocol fidelity and experimental control**. Contact Type** was also associated with significant differences in effectiveness, $Q_{between}$ (1) = 7.99, *p* = .005. Interventions delivered in person yielded stronger effects (*OR* = 1.52 [1.40, 1.66]; *k* = 48) than those delivered remotely (*OR* = 1.44 [1.37, 1.53]; *k* = 111), suggesting that direct interpersonal engagement modestly enhances screening participation relative to remote or mail-based formats. A similar pattern was observed for **Mode of Delivery**, $Q_{between}$ (1) = 5.33, *p* = .021, where individually tailored interventions (*OR* = 1.47 [1.40, 1.54]; *k* = 138) were somewhat more effective than group-based programmes (*OR* = 1.42 [1.25, 1.61]; *k* = 21), emphasising the benefit of personalised approaches.

Differences based on the **Materials** used to deliver the intervention were not statistically significant, $Q_{between}$ (2) = 4.70, *p* = .096. Paper-based interventions produced an average *OR* = 1.47 [1.38, 1.57] (*k* = 91), telephone-based interventions *OR* = 1.43 [1.32, 1.55] (*k* = 35), and electronic materials *OR* = 1.47 [1.31, 1.66] (*k* = 33). This similarity suggests that the communication medium alone does not substantially influence intervention success once the underlying behavioural techniques are held constant. In contrast, the presence of **Reminders** strongly moderated outcomes, $Q_{between}$ (1) = 50.52, *p* < .001. Interventions without reminder components demonstrated higher pooled effects (*OR* = 1.60 [1.38, 1.85]; *k* = 56) than those with reminders (*OR* = 1.39 [1.32, 1.45]; *k* = 103). This pattern likely reflects study composition, reminder-based trials often employed multi-component or large pragmatic designs with more conservative incremental gains rather than a true detrimental effect of reminders.

A weighted random-effects meta-regression tested whether female composition moderated intervention effectiveness. The association was not significant, β = 0.118 (*SE* = 0.103), *p* =

.255. Expressed as a ratio of odds ratios, each 10-percentage-point increase in the proportion of female participants was associated with $ROR = 1.01$, 95% CI [0.99, 1.03] ($k = 159$), indicating no meaningful moderation by gender composition.

Sensitivity Analysis and Heterogeneity

Within-group heterogeneity remained high across subgroups (I^2 values typically 65–90 %), indicating that differences in study design, population, and context continued to contribute to residual variance. A random-effects meta-regression was therefore conducted to examine whether baseline control-group screening rates predicted intervention effectiveness. Results showed a significant negative association, $\beta = -0.72$, $SE = 0.25$, 95 % CI [−1.21, −0.23], $p = .003$, corresponding to an OR ratio of 0.49 per one-unit increase in baseline uptake. Interventions were thus less effective in populations where screening participation was already high, consistent with a ceiling-effect pattern.

Sensitivity analyses confirmed the stability of these findings. Leave-one-out tests indicated that removal of any single study did not materially affect the overall pooled estimate, with the random-effects OR varying between 1.43 and 1.48 (maximum absolute change = 0.03). Separate analyses within reminder and non-reminder subsets produced similarly narrow ranges ($OR_{(yes)} = 1.36$–1.42; $OR_{(no)} = 1.57$–1.63). Fixed-effect models yielded slightly smaller but directionally identical estimates, further supporting the robustness of the results.

Finally, publication bias was assessed using Egger’s regression tests. Across all studies, the intercept was significant ($b = 2.43$, $SE = 0.61$, $p < .001$), indicating some funnel-plot asymmetry consistent with the presence of small-study effects. When examined by subgroup, modest asymmetry was observed for interventions adding objects to the environment ($b = 1.92$, $SE = 0.74$, $p = .009$) and for information-based interventions ($b = 1.51$, $SE = 0.68$, $p = .028$), but not for social-support interventions ($p = .27$). Bias was also evident among research-staff-delivered ($b = 2.05$, $SE = 0.70$, $p = .004$) and remotely delivered ($b = 1.69$, $SE = 0.63$, $p = .011$*) interventions, and in studies incorporating reminders ($b = 2.11$, $SE = 0.67$, $p = .003$). No significant asymmetry was detected for clinically or community-based, in-person, or non-reminder interventions ($p > .10$). Although these results suggest moderate small-study bias in specific subgroups particularly research-led and reminder-based trials the magnitude of bias is unlikely to explain the overall effect. The pooled results remained large and significant under random-effects estimation, indicating that the central conclusion of enhanced screening uptake is robust even after accounting for possible publication bias.

Summary

In summary, across 119 studies, behavioural interventions were consistently associated with greater bowel cancer screening participation compared with control conditions. Intervention type, delivery setting, and contact mode significantly influenced effectiveness, whereas material format showed little impact. Despite some evidence of small-study asymmetry, sensitivity analyses and meta-regression confirmed that the overall pattern of results is stable and that behavioural strategies meaningfully enhance population-level screening uptake. Summary of results displayed within Table 6.2 presented below.

Table 6.2 Subgroup Meta-Analysis Results for Intervention Characteristics

Moderator	***Level / Term***	***K***	***OR / ROR***	***95% CI***	***P***	$Q_{between}$ ***(df)***
Intervention Type	Adding objects to the environment	74	1.48	[1.38, 1.58]	< .001	22.18 (2)*
	Information about health consequences	62	1.41	[1.31, 1.52]		
	Social support (unspecified)	23	1.58	[1.36, 1.83]		
Intervention Setting	Research staff	96	1.48	[1.39, 1.57]	< .001	15.33 (2)*
	Non-clinically	42	1.44	[1.31, 1.57]		

	trained health staff					
	Clinically trained staff	21	1.44	[1.27, 1.63]		
Contact Type	Remote	111	1.44	[1.37, 1.53]	.005	7.99 (1)*
	In-person	48	1.52	[1.40, 1.66]		
Mode of Delivery	Individual	138	1.47	[1.40, 1.54]	.021	5.33 (1)*
	Group	21	1.42	[1.25, 1.61]		
Materials Used	Paper-based	91	1.47	[1.38, 1.57]	.096	4.70 (2)
	Telephone-based	35	1.43	[1.32, 1.55]		
	Electronic	33	1.47	[1.31, 1.66]		
Use of Reminders	Yes	103	1.39	[1.32, 1.45]	< .001	50.52 (1)*
	No	56	1.60	[1.38, 1.85]		

Note. *k* = number of contrasts; OR = odds ratio; *ROR* = relative odds ratio; *CI* = confidence interval; $Q_{between}$ = Cochran’s heterogeneity statistic for between-group differences. Asterisks indicate statistically significant moderator effects ($p < .05$).

6.4.4 Ethnicity as a Moderator of Intervention Effectiveness

Random-effects subgroup analyses were conducted to examine whether intervention effects differed across ethnic groups. Across all eligible trials that reported ethnicity-stratified outcomes (k studies = 72; k = 102 contrasts), interventions were associated with significantly higher bowel cancer screening uptake compared with control conditions in both White and Non-White participants. The pooled random-effects model indicated a large and significant effect among White participants (OR = 1.89, 95 % CI [1.72, 2.09], $p < .001$) and a similarly strong effect among Non-White participants (OR = 1.99, 95 % CI [1.82, 2.18], $p < .001$). The between-group test of heterogeneity was non-significant $Q_{between} = 1.17$, $p = .279$), suggesting that intervention effectiveness did not differ significantly by ethnicity. Heterogeneity within subgroups was moderate (White: $I^2 = 58.3$ %; Non-White: $I^2 = 60.4$ %).

Sensitivity Tests

Leave-one-out and outlier-trimmed sensitivity models confirmed the robustness of these findings. After excluding the most extreme 2.5 % of contrasts, the pooled estimates remained virtually unchanged (White OR = 1.87 [1.69, 2.06]; Non-White OR = 1.95 [1.77, 2.14]). These results indicate that no single study exerted undue influence and that intervention benefits are consistent across ethnic groups.

Ethnicity × Moderator Analyses

To test whether the pattern of intervention effects varied by ethnicity, random-effects subgroup meta-analyses and meta-regressions were conducted for each intervention characteristic: Intervention Type, Intervention Setting, Contact Type, Mode of Delivery, Materials Used, and Use of Reminders. For each moderator, pooled odds ratios were computed separately for White and Non-White participants, followed by Wald χ^2 tests assessing Ethnicity × Moderator interactions.

Across moderators, pooled effects were consistently positive and comparable in magnitude between ethnic groups, indicating that intervention components were generally effective irrespective of ethnicity. The pattern of results suggests broad consistency in behavioural responsiveness across intervention formats and delivery contexts.

Intervention Type

Analysis of intervention type showed that approaches providing information about health consequences and those incorporating social support elements produced the largest pooled effects for both White and Non-White participants. Among White participants, these intervention types yielded a pooled *OR* of 2.18, 95% *CI* [1.81, 2.64] ($k = 25$), while the corresponding effect for Non-White participants was *OR* = 2.29, 95% *CI* [2.02, 2.58] ($k = 23$). These findings indicate that interventions which enhance awareness of the benefits of bowel cancer screening and provide interpersonal encouragement can meaningfully increase uptake across populations. The Ethnicity × Type interaction was non-significant, Wald $\chi^2(2) = 2.46$, $p = .293$, suggesting that these strategies are equally effective across ethnic groups.

Intervention Setting

When examining the setting and personnel delivering the intervention, those implemented by clinically trained staff produced the highest screening uptake. The effect was substantial among both White (*OR* = 2.71 [2.11, 3.48]) and Non-White participants (*OR* = 2.65 [2.08, 3.36]; $k = 6$ for each subgroup). This pattern implies that the credibility and authority associated with healthcare professionals may enhance engagement regardless of cultural background. The Ethnicity × Setting test was non-significant, Wald $\chi^2(3) = 3.84$, $p = .280$, indicating that professionally delivered interventions are similarly persuasive in both groups.

Contact Type

Interventions involving in-person contact generated stronger effects than those delivered remotely. For White participants, in-person delivery produced an average *OR* of 2.21 [1.87, 2.62] ($k = 29$), and for Non-White participants the corresponding effect was *OR* = 2.41 [2.06, 2.81] ($k = 22$). Although the difference between groups was not statistically significant, Wald $\chi^2(1) = 0.96$, $p = .327$, these findings reinforce the value of interpersonal engagement and personalised contact as universal facilitators of bowel cancer screening participation.

Mode of Delivery

Similarly, group-based delivery was associated with slightly higher effects than individual formats for both ethnic groups. White participants exhibited *OR* = 2.54 [2.06, 3.14] ($k = 17$), and Non-White participants *OR* = 2.79 [2.33, 3.35] ($k = 15$). The Ethnicity × Mode interaction was not significant, Wald $\chi^2(1) = 1.21$, $p = .272$. These comparable gains suggest that group settings may promote shared motivation and collective norms that encourage screening uptake, and that these psychosocial mechanisms are culturally transferable rather than specific to one population.

Materials Used

When examining communication materials, interventions employing electronic formats demonstrated robust pooled effects across both subgroups (White *OR* = 2.13 [1.79, 2.52], *k* = 25; Non-White *OR* = 2.27 [1.97, 2.61], *k* = 20). The Ethnicity × Materials interaction was not significant, Wald $\chi^2(2) = 1.84$, *p* = .399. These results suggest that digital and technology-based materials are effective across ethnic groups, and that digital accessibility does not appear to moderate intervention impact.

Use of Reminders

Finally, the use of reminder systems such as letters, phone calls, or text messages, was strongly associated with higher bowel cancer screening uptake in both groups. White participants showed *OR* = 2.12 [1.74, 2.58] (*k* = 14), and Non-White participants *OR* = 2.13 [1.87, 2.42] (*k* = 54). The Ethnicity × Reminder interaction was non-significant, Wald $\chi^2(1) = 0.32$, *p* = .571, confirming that reminder-based interventions are universally beneficial. These effects align closely with previous evidence showing reminders to be one of the most potent implementation strategies for sustaining screening adherence (e.g., Tsipa et al., 2020).

Summary

Across all moderators, there were no reliable Ethnicity × Moderator interactions, and the direction of effects was consistent across groups. Intervention components that were effective for White participants also conferred comparable benefits for Non-White participants. Although slight numerical differences were observed in magnitude, these did not reach statistical significance after accounting for study-level variance. This consistent pattern suggests that key mechanisms like enhancing knowledge, increasing self-efficacy, and directly facilitating screening through reminders or clinician engagement, function similarly across ethnic populations. Consequently, tailoring interventions by ethnicity may not be necessary to achieve core behavioural effects, although context-specific adaptations may still improve cultural resonance and accessibility.

Sensitivity and Robustness Checks

To evaluate the stability and robustness of the ethnicity-stratified findings, a series of sensitivity analyses were conducted. These analyses aimed to determine whether the pooled estimates were influenced by extreme or outlying effect sizes, by individual studies with particularly large weights, or by methodological heterogeneity across included trials.

Leave-one-out analysis

Each study contrast was sequentially removed from the dataset, and the random-effects model was re-estimated for both ethnic subgroups. Across iterations, pooled *ORs* fluctuated minimally (< 0.03 in either direction), and no single contrast materially altered the magnitude or significance of the pooled effects (White *OR* range = 1.86–1.91; Non-White *OR* range = 1.95–2.02). This indicates that the overall pattern of intervention effectiveness was not driven by any single influential study.

Outlier-trimmed models.

To further assess the impact of extreme estimates, the upper and lower 2.5 % of contrasts were excluded, corresponding to the most extreme log-odds ratios on either tail of the distribution. Following trimming, the pooled estimates remained virtually unchanged (White *OR* = 1.87 [1.69, 2.06]; Non-White *OR* = 1.95 [1.77, 2.14]) and heterogeneity decreased slightly (White I^2 = 56.7 %; Non-White I^2 = 58.1 %). These results suggest that the high heterogeneity observed in the untrimmed model was not due to aberrant studies but reflected genuine variability across intervention contexts.

Publication-bias and small-study checks

Egger’s regression tests were also run separately for White and Non-White subsets. Both intercepts were non-significant ($p > .10$), suggesting no evidence of small-study bias within either subgroup. Funnel plots were broadly symmetrical, reinforcing the conclusion that differential publication bias does not explain the observed equivalence of effects.

Summary

Across all sensitivity and robustness tests, the results consistently demonstrated that the observed parity in intervention effectiveness between White and Non-White participants is highly stable. No single study, extreme contrast, or analytic choice meaningfully altered the direction or magnitude of the pooled effects. This provides strong confidence that the lack of significant Ethnicity × Moderator interactions reflects a genuine equivalence in behavioural response rather than an artefact of sampling, weighting, or outlier influence. See Table 6.3 below for a summary of results.

Table 6.3 Ethnicity and Moderator Analyses (Random-Effects Meta-Analysis)

Moderator	**Level/Term**	**Ethnic Group**	**K**	**OR**	**95% CI**	$Q_{between}$ / **Wald χ^2 (df, p)**
Overall	—	White	95	1.89	[1.72, 2.09]	$Q_{between}$ (1)=1.17, p=.279
Overall	—	Non-White	95	1.99	[1.82, 2.18]	—
Intervention Type	Information / Social Support / Adding Objects	White	25	2.18	[1.81, 2.64]	Wald χ^2(2)=2.46, p=.293
Intervention Type	Information / Social Support / Adding Objects	Non-White	23	2.29	[2.02, 2.58]	—
Intervention Setting	Clinically / Non-Clinically / Research Staff	White	6	2.71	[2.11, 3.48]	Wald χ^2(3)=3.84, p=.280

Intervention Setting	Clinically / Non-Clinically / Research Staff	Non-White	6	2.65	[2.08, 3.36]	—
Contact Type	Remote vs In-person	White	29	2.21	[1.87, 2.62]	*Wald* $\chi^2(1)=0.96$, *p*=.327
Contact Type	Remote vs In-person	Non-White	22	2.41	[2.06, 2.81]	—
Mode of Delivery	Individual vs Group	White	17	2.54	[2.06, 3.14]	*Wald* $\chi^2(1)=1.21$, *p*=.272
Mode of Delivery	Individual vs Group	Non-White	15	2.79	[2.33, 3.35]	—
Materials Used	Electronic / Paper / Telephone	White	25	2.13	[1.79, 2.52]	*Wald* $\chi^2(2)=1.84$, *p*=.399
Materials Used	Electronic / Paper / Telephone	Non-White	20	2.27	[1.97, 2.61]	—
Use of Reminders	Present vs Absent	White	14	2.12	[1.74, 2.58]	*Wald* $\chi^2(1)=0.32$, p=.571
Use of Reminders	Present vs Absent	Non-White	54	2.13	[1.87, 2.42]	—

Note. Pooled odds ratios (*OR*) and 95% confidence intervals (*CI*) are presented separately for White and Non-White participants. $Q_{between}$ and Wald χ^2 tests assess whether intervention effects differ significantly by ethnicity. All models use random-effects estimators. *ns* = non-significant.

6.5 Discussion

This systematic review and meta-analysis synthesised evidence from 119 randomised controlled trials (159 contrasts) designed to increase bowel cancer screening participation. Using random-effects models, interventions produced a significant improvement in screening uptake compared with control conditions (*OR* = 1.46, 95% *CI* [1.40, 1.53]), and this effect remained robust across sensitivity and publication bias tests. Heterogeneity was high, indicating meaningful variability in effect sizes, which was investigated through moderator analysis. Subgroup and meta-regression analyses demonstrated that intervention effectiveness varied more as a function of intervention design and delivery characteristics than participant demographics. Specifically, intervention type, delivery setting, contact mode, and use of reminders significantly moderated outcomes, whereas gender and age did not. Ethnicity-stratified analyses showed that interventions were equally effective for both White (*OR* = 1.89) and Non-White participants (*OR* = 1.99), with no significant Ethnicity × Moderator interactions. These findings indicate that intervention strategies can improve screening participation across diverse populations and that variability in effectiveness is best understood in terms of modifiable implementation features rather than fixed participant characteristics.

6.5.1 Overall Effectiveness of Interventions

Across the 119 randomised controlled trials included in this review (159 contrasts), interventions demonstrated a consistent and statistically significant improvement in bowel cancer screening uptake compared with control conditions. The overall pooled effect from the random-effects model indicated a moderate but meaningful effect (*OR* = 1.46, 95% *CI* [1.40, 1.53]), showing that interventions reliably outperform usual care. Although there was substantial heterogeneity (I^2 = 94%), sensitivity analyses confirmed that this effect was stable and not driven by single studies, extreme values, or risk of bias. Publication bias tests indicated some evidence of small-study effects; however, the pooled estimate remained robust, strengthening confidence in the overall finding.

These results extend previous meta-analyses, which reported smaller effects (e.g., *ORs* between 1.20–1.35; Baron et al., 2008; Holden et al., 2010; Tsipa et al., 2020), suggesting that the potency of interventions has increased over time. This difference may reflect the growing adoption of implementation strategies such as mailed FIT kits, structured reminder systems, GP-endorsed invitations, and navigator-based support. Additionally, a shift toward multi-component designs combining practical facilitation with behavioural support may account for improvements in effectiveness observed in more recent trials.

Importantly, the current findings align with the psychosocial determinants of screening behaviour identified in earlier chapters of this thesis. Interventions most strongly associated with behaviour change in this review such as those adding objects to the environment (e.g., test kits), simplifying processes, or offering supportive contact map directly onto constructs such as intention, self-efficacy, and response efficacy. This supports the interpretation that effective interventions operate through established behavioural mechanisms rather than solely procedural or logistical means.

In summary, the evidence indicates that bowel cancer screening interventions are effective, replicable, and adaptable across diverse healthcare settings and populations. Their success appears to reflect both design features (e.g. behavioural components, practical facilitation) and theoretical relevance to psychosocial barriers to screening. These findings provide a strong foundation for future intervention development and implementation strategies aimed at improving population-level participation and reducing preventable mortality from bowel cancer.

6.5.2 Intervention Characteristics

A central conclusion of this review is that variation in intervention effectiveness is driven more by what interventions do than who they target. Across the evidence base, intervention characteristics particularly those that reduce practical barriers and support action consistently distinguished more successful strategies from weaker ones.

Interventions that simplified access to screening were especially effective. Approaches that mailed FIT/gFOBT kits directly to individuals overcame a major practical hurdle by enabling screening at home, without the need for clinical attendance or complex procedures. This reflects a well-established behavioural principle: reducing friction increases participation (Michie et al., 2013; Rogers, 1975). In earlier chapters of this thesis, perceived barriers emerged as one of the strongest negative predictors of screening intention and behaviour; these findings demonstrate that reducing barriers is not only predictive, but a causal mechanism leveraged by effective interventions. This supports the argument that structural enablement not simply education plays a central role in promoting public health behaviours (Tsipa et al., 2020).

Interventions based on information provision also performed well, particularly when they addressed the personal relevance and benefits of screening rather than simply presenting procedural facts. This aligns with theories such as the Health Belief Model (Rosenstock, 1974) and Protection Motivation Theory (Rogers, 1975), which propose that risk appraisal and benefit evaluation shape preventive behaviours. However, information alone was less effective when not paired with practical facilitation, reinforcing the principle that motivation without opportunity rarely translates into action (Sheeran & Webb, 2016).

The role of social support was also notable. Interventions involving patient navigation or interpersonal encouragement whether via trained health workers or community peers were particularly useful for shifting people who were aware of screening but uncertain or ambivalent about participation. These strategies enhance self-efficacy and address emotional and cultural barriers, consistent with Social Cognitive Theory (Bandura, 1986). This resonates with earlier findings in this thesis where self-efficacy was a consistent positive predictor of screening uptake. These results suggest that beyond information and access, individuals benefit from relational support that normalises the behaviour and reduces anxiety about participation.

Delivery format also contributed to intervention success. In-person contact appeared to offer a meaningful advantage over remote methods (such as letters, emails, or automated messages), likely because it allows for tailored reassurance and problem-solving. Remote strategies are valuable for reach and scalability but may lack the interactive component needed to overcome entrenched hesitation. This finding highlights a continuing implementation dilemma: while remote strategies are cost-effective, relational contact still matters and should not be abandoned in pursuit of efficiency.

Group-based delivery showed potential, particularly in communities where bowel screening may carry stigma or cultural hesitation. Group formats appear to activate social norms and collective motivation, mechanisms captured in the Theory of Planned Behaviour (Ajzen, 1991) and previously highlighted in Chapter 4. However, such interventions also displayed greater variability in outcomes, likely due to differences in cultural tailoring and facilitation quality. This suggests that group-based strategies are most appropriate where community engagement is necessary, such as underserved or ethnically diverse populations.

Differences in provider type were also revealing. Interventions delivered by research teams tended to perform better than those led by practitioners in routine services. This is unlikely to reflect provider skill alone but rather fidelity and resourcing differences between controlled trials and real-world settings (Goodwin et al., 2019). The implication is clear: effective intervention content is not enough; implementation quality is critical.

The role of reminders requires careful interpretation. On face value, reminder-based interventions appeared to produce modest effects, but this reflects their frequent use in large-scale national programmes, where baseline uptake is already high and gains are harder to achieve. Behavioural science identifies reminders as effective action cues (Michie et al., 2013), and within this review, reminders worked best when integrated with strategies that also addressed motivation and barriers. As such, reminders should be viewed as essential but insufficient on their own their value lies in supporting intention enactment within multi-component designs (Sheeran & Webb, 2016).

Finally, initial delivery materials whether paper, telephone, or digital had little impact on effectiveness. This indicates that how people are contacted matters less than what they are offered. However, digital-only strategies risk excluding individuals with lower digital access or confidence (Robb et al., 2008); therefore, inclusive design remains essential.

Taken together, these findings demonstrate that effective bowel screening interventions work by removing friction, strengthening motivation, and supporting action. The most successful strategies are those that combine behavioural enablement with psychological support, aligning closely with the mechanisms identified in the earlier chapters of this thesis. These results emphasise that future programme design should move beyond information campaigns and adopt interventions that make screening easy, supported, and personally meaningful.

6.5.3 Intervention Effects Across Ethnic Groups

One of the aims of this review was to explore whether intervention effects varied across ethnic groups. The analysis suggested broadly comparable intervention benefits for both White and Non-White participants. Although ethnicity did not emerge as a statistically reliable moderator in the pooled analysis, this does not necessarily imply that ethnicity is unimportant in shaping behavioural response to screening interventions. Instead, it may suggest that many intervention components address behavioural determinants such as opportunity, reminders, and motivational support that are relevant across population groups.

The observation of similar relative improvements across ethnic groups aligns with population research suggesting that, when presented with accessible and well-delivered interventions, individuals from diverse backgrounds can engage positively with screening programmes (Robb et al., 2008; Szczepura et al., 2008). Nonetheless, relative gains may not fully resolve underlying inequalities because some ethnic minority populations begin from lower baseline participation rates. As a result, equivalent intervention effects may still leave absolute gaps in uptake. This highlights the ongoing importance of implementation strategies that consider contextual and structural factors influencing participation.

While analyses in this review necessarily used a harmonised White versus Non-White framework to enable synthesis across studies, this does not preclude the possibility that there are important within-group differences or contextual influences that may shape responsiveness. It remains possible that cultural preferences, language, trust in healthcare systems, and access to primary care could influence intervention engagement in ways not fully captured here. Consistent with this view, previous work has highlighted the value of enhancing reach and acceptability through culturally appropriate communication, community partnerships, and trusted messengers (Rana et al., 2023).

Overall, these findings suggest that standard behavioural intervention strategies may be applicable across ethnic groups, but thoughtful adaptation during implementation may enhance equity in reach and impact. The findings point towards a more nuanced conclusion: that core intervention mechanisms appear to generalise, while population-specific considerations may still shape real-world effectiveness. Future research should continue to examine equity alongside effectiveness to ensure screening strategies are both robust and inclusive.

6.5.4 Intervention Effects Across Genders

Gender differences were less pronounced but still notable. Gender differences in intervention responsiveness were small. Although descriptive patterns suggested marginally stronger intervention effects in samples with a higher proportion of men, the meta-regression indicated that gender composition did not significantly moderate intervention effectiveness. One possible explanation is that lower baseline participation among men may create slightly more scope for improvement, whereas women, who typically show higher initial uptake, may exhibit ceiling effects that limit observable gains. This pattern is consistent with broader evidence that men engage less frequently with preventive health services, including cancer screening (Gascoyne et al., 2023). However, given the absence of a reliable moderating effect, the findings suggest that the behavioural strategies used in screening interventions operate similarly across genders, while still allowing for the possibility that gender-sensitive framing such as addressing embarrassment, family responsibility, or social norms may enhance relevance in practice.

6.5.5 Linking Intervention Effects to Behavioural Predictors

An important contribution of this review is the way it connects intervention effects to the psychosocial predictors of bowel cancer screening behaviour identified in earlier chapters of this thesis. Chapter 4 synthesised international evidence and highlighted intention, self-efficacy, perceived benefits, and perceived barriers as consistent predictors of screening participation. Chapter 5 extended this work by demonstrating cross-cultural consistency in these constructs across India and the United Kingdom, showing that coping appraisal variables from Protection Motivation Theory (PMT) particularly self-efficacy and response efficacy were strong predictors of intention, while perceived barriers were the most reliable negative determinant of both intention and behaviour.

The present meta-analysis reinforces these findings through triangulation with intervention evidence. Interventions that achieved the strongest effects were those that directly addressed key behavioural mechanisms identified in earlier chapters. For example, mailed test kits and simplified screening procedures coded in this review as “adding objects to the environment” reduced practical barriers and effort, helping to translate intention into action. This aligns with PMT, which posits that reducing response costs increases the likelihood of adopting protective behaviour. Likewise, interventions providing clear, concise screening information consistently improved uptake. These approaches map onto response efficacy by increasing beliefs about the effectiveness and value of screening, reflecting the important role of appraisal processes highlighted in Chapter 5.

Supportive contact interventions delivered via telephone, navigation services, or in-person support also performed well. These strategies build confidence by offering reassurance, guidance, and emotional support, thereby enhancing self-efficacy. This is consistent with both PMT and Bandura's Social Cognitive Theory, as well as the findings of Chapter 5, where self-efficacy emerged as one of the strongest predictors of screening intention in both cultural contexts. Although interventions incorporating reminders showed slightly smaller pooled effects compared with those without reminders, this pattern reflected study design rather than mechanism; reminder components remain theoretically meaningful because they support volitional processes such as memory retrieval, planning, and action maintenance.

Group-based formats showed positive effects but were not consistently superior to individually delivered interventions in the current analysis. Their influence may lie partly in shaping subjective norms identified in Chapter 4 as weaker but still meaningful predictors of intention by providing visible social endorsement of screening. However, because subjective norms may operate differently depending on cultural or social context, their contribution may be indirect and context-dependent rather than universal.

Together, these converging findings provide theoretical coherence across observational and intervention evidence. The fact that interventions that modify intention, self-efficacy, perceived barriers, and perceived effectiveness also demonstrate stronger behavioural impact strengthens confidence that these constructs represent mechanisms of change rather than mere correlates. This interpretation is consistent with broader behavioural science literature on cancer screening (Sheeran et al., 2016; McEachan et al., 2011), which similarly highlights the central role of capability, motivation, and opportunity constructs in shaping behaviour.

However, as in previous literature, relatively few intervention trials in this review explicitly measured psychological constructs or tested mediation pathways. As a result, evidence of mechanisms remains inferential rather than direct. Future intervention studies should incorporate validated measures of behavioural determinants and include mediation analyses to assess how changes in constructs such as self-efficacy and perceived barriers translate into screening uptake. This would support stronger causal inference and enable more efficient intervention optimisation.

In summary, findings across Chapters 4, 5, and 6 demonstrate theoretical consistency: screening participation is influenced by a core set of psychological determinants, and interventions that explicitly target these constructs show stronger uptake effects. Embedding intervention design within frameworks such as PMT and the Theory of Planned Behaviour, while reducing practical barriers and enhancing confidence, offers a coherent, evidence-based route to increasing bowel cancer screening participation.

6.5.6 Implications for Intervention Design and Policy

The findings of this review highlight several practical implications for strengthening bowel cancer screening uptake in population programmes. Evidence suggests that interventions are most effective when they address both structural and motivational determinants of behaviour. Consistent with this, strategies that reduce effort and increase opportunity to act such as mailing test kits and simplifying return procedures should remain central components of screening programmes. These approaches directly reduce practical barriers and support translation of intention into action. Clear, plain-language communication should also be prioritised, as information that enhances understanding of screening purpose and effectiveness appears to strengthen motivation and perceived value of participation.

Supportive contact emerged as another consistently useful strategy, whether delivered through GP endorsement, telephone navigation, or community outreach. By offering reassurance and addressing concerns, supportive contact may help to build confidence and resolve practical challenges, making it particularly valuable for individuals who are ambivalent or uncertain about screening. Reminder systems also contributed positively across studies and are likely to be most effective when implemented as part of multi-component strategies that support follow-through rather than awareness alone.

Importantly, the evidence suggests that intervention components function similarly across ethnic and gender groups, indicating that behaviour change mechanisms are broadly transferable. However, comparable relative effects do not necessarily guarantee equity in absolute outcomes. Populations with lower baseline uptake may still require additional support to achieve comparable participation. Therefore, universal intervention strategies remain essential but should be implemented in ways that are sensitive to cultural, linguistic, and social context. Layering culturally relevant communication, accessible materials, and trusted messengers onto universal approaches may enhance reach and acceptability without fragmenting delivery.

From a policy perspective, these findings reinforce the value of intervention designs that integrate behavioural science principles within routine screening delivery. Programmes may benefit from adopting a structured behaviour change framework that systematically targets barriers, strengthens perceived benefits, and builds confidence in completion. Monitoring of uptake by sociodemographic characteristics including ethnicity, gender, and socioeconomic status should continue to inform adaptive implementation and ensure that gains in participation are distributed fairly. While digital innovations such as patient portals and text reminders offer promise, they should complement rather than replace traditional delivery methods to avoid widening access gaps.

Overall, effective and equitable intervention strategies are those that combine practical enablement with motivational support while remaining flexible to local needs. Designing interventions with both effectiveness and inclusion in mind will support progress towards improved population screening outcomes and reduced disparities in bowel cancer detection.

6.5.7 Methodological Considerations and Future Directions

The findings of this review raise several methodological considerations for future intervention research. Trials delivered by research staff tended to report slightly larger effects than those implemented by clinical or community-based personnel, which may reflect differences in intervention fidelity and controlled delivery conditions. This highlights the importance of pragmatic trial designs that evaluate effectiveness under routine service conditions, where resource constraints and population diversity may influence implementation.

Although ethnicity did not emerge as a significant moderator of intervention effectiveness, the harmonisation of ethnic categories into a binary framework limited the capacity to explore within-group variation. Future research would therefore benefit from more detailed and consistent reporting of participant characteristics, including disaggregated ethnicity data and social determinants of health. This would support a more accurate understanding of how interventions perform across diverse populations.

High heterogeneity across studies indicates that behavioural response to intervention is influenced by contextual and implementation factors. Embedding process evaluations within trials would help to identify mechanisms of action, optimise active components, and explain variability in outcomes. Few included trials explicitly measured psychosocial constructs such as intention, perceived barriers, or self-efficacy, and mediation analyses were rarely conducted. Incorporating theoretically informed measures would enable stronger tests of behavioural mechanisms and provide clearer links between intervention strategies and behavioural outcomes.

Future work should also evaluate digital and technology-enabled strategies while paying careful attention to equity and access. Although digital approaches offer efficiency and scalability, they may inadvertently exclude groups with limited digital literacy or access. Implementation science methods, including hybrid effectiveness–implementation designs and equity-focused evaluation frameworks, provide valuable opportunities to examine not only whether interventions work, but how they can be delivered sustainably, at scale, and in ways that promote fair access to screening.

6.5.8 Strengths and Limitations

This review has several notable strengths. First, it represents one of the most comprehensive syntheses of randomised controlled trials of bowel cancer screening interventions to date, including 119 studies and over one million participants across diverse healthcare systems and international contexts. Restricting inclusion to RCTs enhanced internal validity and minimised the risk of confounding, providing robust estimates of intervention effectiveness. A further strength is the systematic and detailed coding of intervention, participant, and methodological characteristics, which enabled nuanced moderator analyses that clarified how design features such as intervention type, delivery setting, contact format, and reminder use influence outcomes. By explicitly examining equity-relevant moderators, including ethnicity and gender, the review moved beyond average effects to explore whether interventions operate consistently across population groups. Although no reliable moderation by ethnicity or gender was observed, testing these effects directly represents an important advance in addressing questions of reach and inclusivity. Finally, by mapping intervention effects onto the behavioural predictors of screening identified in earlier thesis chapters, the review strengthened theoretical integration and illustrated how constructs such as intention, self-efficacy, and perceived barriers function within intervention contexts.

Despite these contributions, the review also has limitations. Substantial heterogeneity across studies indicates that pooled estimates should be interpreted cautiously, as intervention effects varied by context, implementation, and population characteristics. The categorisation of ethnicity into a harmonised White versus Non-White framework, while necessary for synthesis, limited the ability to explore within-group variation or cultural nuance and may have masked differences between specific ethnic communities. Similarly, gender effects were evaluated at the aggregate level, preventing analysis of intersectional influences, such as ethnicity by gender or gender by socioeconomic status. The decision to restrict the review to RCTs strengthened internal validity but may have excluded pragmatic evidence from real-world implementation studies, which could offer additional insights into feasibility and scalability. Finally, the English-language restriction may have led to the omission of relevant evidence from non-English-speaking regions, potentially limiting the global applicability of the findings.

6.5.9 Conclusion

This review demonstrates that bowel cancer screening interventions can improve uptake across diverse populations, with effectiveness driven more by intervention design than by fixed participant characteristics. Interventions that reduced practical barriers, such as mailing test kits and simplifying return procedures, consistently improved participation. Clear information and supportive contact also enhanced engagement by increasing confidence and resolving uncertainties, while reminder strategies were most effective when combined with other components.

Analyses indicated broadly similar intervention effects across ethnic and gender groups, though this should be interpreted cautiously. The absence of moderation does not imply that ethnicity or gender are unimportant, but rather that intervention mechanisms may operate similarly across groups when access is enabled. Inclusive programme design and equitable delivery therefore remain essential to ensure proportional benefit.

Findings align with earlier chapters of this thesis, reinforcing intention, self-efficacy, response efficacy, and perceived barriers as mechanisms of behaviour change. Interventions that target these constructs are most likely to achieve impact. Overall, theory-informed and context-sensitive interventions offer a practical strategy to increase screening participation and support early detection.

6.7 Chapter Summary

This chapter presented a systematic review and meta-analysis of 119 randomised controlled trials designed to increase participation in bowel cancer screening. The review examined the overall effectiveness of interventions, explored whether effects varied by ethnicity and gender, and identified which intervention characteristics were most strongly associated with screening uptake. Consistent with the broader thesis aim, the findings demonstrate that screening behaviour can be modified and that intervention effects are shaped more by how interventions are designed and delivered than by fixed participant attributes.

Interventions that removed practical barriers and supported action such as mailing test kits, simplifying return procedures, and providing clear information were consistently effective. Supportive contact enhanced uptake by offering guidance and reassurance, and reminder strategies contributed positively when integrated as part of multi-component designs. These findings align with Chapter 4, which identified perceived barriers, perceived benefits, and intention as key predictors of screening behaviour, and with Chapter 5, which showed that self-efficacy and response efficacy are important motivational drivers across cultural contexts. The present findings extend this earlier evidence by showing that interventions targeting these mechanisms achieve stronger behavioural impact.

Equity-focused analyses further developed the thesis discussion on inequalities introduced in Chapter 1 and explored empirically in Chapter 5. Although no reliable moderation by ethnicity or gender was found, this does not suggest that these factors are irrelevant. Instead, the results indicate that when interventions are accessible, clearly communicated, and practically enabling, they are effective across population groups. However, differences in baseline participation emphasise the continued need for inclusive implementation to ensure equitable reach.

Overall, this chapter strengthens the thesis argument that theory-informed approaches can meaningfully improve screening uptake. By demonstrating that intervention components linked to intention, self-efficacy, response efficacy, and reduced barriers are most successful, Chapter 6 builds a bridge between behavioural determinants (Chapters 4–5) and applied solutions. In doing so, it highlights how behavioural science can inform scalable and equitable intervention strategies, advancing the central goal of the thesis to improve participation in bowel cancer screening and reduce preventable inequality in early cancer detection.

Chapter 7

General Discussion

7.1 Chapter Overview

This chapter provides a comprehensive synthesis of the thesis by integrating findings across all studies and aligning them with the overarching research aims. It critically reflects on the barriers, facilitators, and psychosocial predictors of bowel cancer screening participation identified in both UK and Indian populations, drawing on insights from qualitative, quantitative, and review-based evidence. The chapter highlights the main contributions of the work, discusses its strengths and limitations, and considers the implications for theory, practice, and policy. It concludes with actionable recommendations to inform the design and delivery of effective bowel cancer screening interventions and outlines directions for future research to further enhance screening uptake and reduce inequalities in cancer prevention.

7.2 Thesis Aim and Integration of Findings

Bowel cancer is a leading cause of cancer morbidity and mortality worldwide, yet uptake of available screening programmes remains persistently suboptimal, particularly among individuals from lower socioeconomic groups and ethnic minority populations (Cancer Research UK, 2025; Indian Cancer Society, 2023). Despite the demonstrated effectiveness of screening in detecting cancer early and improving survival rates, disparities in participation undermine the potential of these programmes to boost screening uptake. Understanding the barriers, facilitators, psychosocial predictors, and effectiveness of current interventions is therefore critical for reducing inequalities and informing public health strategies in both high-income and lower-middle-income settings.

The overall aim of this thesis was to identify the barriers and facilitators of bowel cancer screening across different groups, to identify and examine psychosocial and demographic predictors of screening intention and behaviour, and to evaluate the effectiveness of interventions aimed at increasing uptake. These objectives were pursued through four comprehensive studies: a qualitative cross-cultural comparison, a systematic review of screening predictors, a large cross-sectional survey-based study, and a systematic review and meta-analysis of screening interventions. Together, these studies provide a comprehensive, cross-cultural perspective on the determinants of bowel cancer screening and yield insights into how interventions can be better tailored to reduce disparities and improve screening uptake. (Refer to Figure 7.1 below for an overview).

Objective 1: To identify and examine the barriers and facilitators of bowel cancer screening across different groups

This objective was addressed through a qualitative cross-cultural study (Study 1, presented in Chapter 3). Thirty participants from three groups White British, Indian immigrants in the UK, and Indian residents were interviewed to explore their perceptions, experiences, and attitudes toward bowel cancer screening. Reflexive thematic analysis generated five overarching themes: accessibility constraints, lack of awareness, need for education, test result anxiety, and negative attitude towards preventive healthcare.

The findings highlighted the role of structural and cultural barriers in shaping screening participation. For instance, while White British participants emphasised socioeconomic challenges and logistical barriers, Indian and Indian-immigrant participants reported a lack of awareness and education, combined with cultural perceptions of preventive healthcare. Indian-immigrant participants appeared to share characteristics of both groups: like Indian participants, they discussed gaps in awareness and reliance on family influence, yet similar to White British participants, they also reflected increasing familiarity with preventive healthcare through the NHS, resulting in comparatively more positive screening attitudes. These findings aligned with the thesis aim of identifying barriers and facilitators across groups and underscored the need for culturally nuanced interventions. Importantly, the themes also provided a foundation for subsequent studies: awareness and education were explored further in the predictors review (Chapter 4), while self-efficacy and barriers became central constructs in the survey (Chapter 5).

Objective 2: To identify and examine predictors of bowel cancer screening intention and behaviour across different groups

This objective was addressed in two stages. First,

Chapter 4 presented a systematic review and meta-analysis of psychosocial predictors. Drawing on 84 studies from diverse countries and screening contexts, the review quantified associations between psychosocial constructs and both screening intention and behaviour. The results indicated that coping appraisal variables from Protection Motivation Theory

(PMT) particularly self-efficacy (*r* = .16 for behaviour) and perceived barriers (*r* = –.13) were the most consistent predictors. Knowledge and perceived benefits were also reliable predictors of intention, while intention itself emerged as a strong yet modest but predictor of behaviour (*r* = .17).

These findings confirmed and extended the insights from the qualitative study, showing that knowledge and self-efficacy are central to intention formation, while perceived barriers impede behaviour. The systematic review thus advanced the thesis aim by specifying which constructs should be prioritised in interventions and by providing a quantitative synthesis of the global evidence base.

Second, Chapter 5 (Study 2) built directly on this review by empirically testing PMT constructs and demographic variables in a large cross-sectional survey of over 2,000 participants from the UK and India. The study confirmed that self-efficacy, response efficacy, and perceived barriers were robust predictors of screening intention, even after controlling for demographics. Crucially, cross-cultural comparisons revealed significant variation: predictors operated differently across India, UK-Asian, and UK-Non-Asian groups. For example, self-efficacy effects were stronger in India, while response efficacy was more influential in the UK. Demographic moderators such as age, gender, education, and prior screening history further shaped screening intention.

This study addressed the objective of testing predictors across cultural contexts, demonstrating both universal and context-specific determinants of intention. It provided empirical evidence that psychological constructs interact with demographic and cultural factors, reinforcing the thesis aim of understanding variability across groups. Together with Chapter 4, it established a strong case for tailoring interventions to target self-efficacy and barrier reduction while also accounting for cultural and demographic diversity.

Objective 3: To examine the effectiveness of existing bowel cancer screening interventions across different groups and inform inclusivity

This objective was met in Chapter 6, which evaluated the effectiveness and equity of bowel cancer screening interventions through a systematic review and meta-analysis of 119 randomised controlled trials (159 contrasts). The findings directly addressed the objective by demonstrating that interventions were effective overall (random-effects *OR* = 1.46, 95% *CI*

[1.40, 1.53]) and by identifying which intervention characteristics produced the greatest improvements in screening uptake. Crucially, the analysis showed that effectiveness was driven more by modifiable intervention features than by participant demographics, meaning that barriers to participation can be reduced through intervention design rather than being inherent to specific groups. This advances the objective by showing how interventions can be optimised to enhance equity rather than widen disparities.

The chapter also examined intervention effects across ethnic groups, fulfilling the inclusivity component of the objective. Although ethnicity has previously been assumed to limit intervention impact, this review found no significant differences in effectiveness between White (*OR* = 1.89) and Non-White (*OR* = 1.99) participants, and no Ethnicity × Moderator interactions. This indicates that core behavioural mechanisms work similarly across ethnic groups but also highlights that equal relative effects do not eliminate absolute disparities, as some minority groups begin with lower baseline uptake. This finding is central to the thesis aim of reducing inequalities, as it suggests that interventions do not need to be entirely redesigned for different ethnic groups, but they must be implemented in ways that improve accessibility and reach.

Finally, Objective 3 required linking intervention evidence to the psychosocial predictors identified earlier in the thesis. Chapter 6 confirmed that interventions were most effective when they targeted self-efficacy, response efficacy, and perceived barriers, directly aligning with the predictors identified in Chapters 4 and 5. This demonstrates that behaviourally informed intervention strategies are essential for improving screening participation across groups, and that theoretical constructs identified earlier in this thesis translate into real intervention impact. In this way, the chapter not only reviewed effectiveness but also provided evidence-based direction on how future interventions can be designed to be both effective and inclusive, fully meeting the third objective.

Synthesis of Findings in Relation to Thesis Aims

Taken together, the two reviews and the two empirical studies advance the overarching thesis aim of understanding and examining bowel cancer screening behaviour and intention across different groups with a focus on identifying predictors of bowel cancer screening intention and informing ways to improve screening uptake across different groups. Study 1 established the qualitative foundations by identifying key barriers and facilitators across cultural groups. Chapter 4 provided quantitative synthesis of international evidence, highlighting the most consistent psychosocial predictors of screening outcomes. Study 3 tested these predictors in a large, cross-cultural sample, revealing both universal and context-specific effects. Finally, Chapter 6 evaluated the effectiveness of interventions, demonstrating that strategies which target self-efficacy, barriers, and knowledge are most effective, especially when culturally tailored.

By triangulating the qualitative, quantitative, and review-based evidence, the thesis shows that bowel cancer screening behaviour is shaped by an interplay of psychological constructs, cultural context, and intervention design. Importantly, the integration of findings underscores that interventions will only succeed if they are theoretically grounded, culturally sensitive, and responsive to demographic differences. This synthesis not only fulfils the thesis objectives but also generates actionable insights for policymakers, practitioners, and researchers seeking to improve cancer screening uptake and reduce health inequalities.

Objective 1:
Identify and examine barriers and facilitators
Study 1 – Qualitative study (Chapter 3)
Outcome: Awareness, education, SES, and attitudes towards screening were key barriers/facilitators.

↓

Objective 2:
Identify and examine predictors of screening intention & behaviour
Study 2 – Systematic review (Chapter 4)
Outcome: Self-efficacy, barriers, and knowledge were most consistent predictors.

Study 3 – Cross-sectional survey (Chapter 5)
Outcome: Predictors varied cross-culturally; self-efficacy stronger in India, response efficacy in UK.

↓

Objective 3:
Examine effectiveness of interventions across groups
Study 4 – Systematic review of interventions (Chapter 6)
Outcome: Interventions improved uptake overall; theory-based strategies most effective.

Figure 7.1 The key findings in relation to the thesis aims outlined in Chapter 1

7.3 Key findings in consideration of the existing literature

7.3.1 Thesis Objective 1: Identify and examine the barriers and facilitators of bowel cancer screening across different groups

Key Extension 1: Cross-cultural differences

This thesis purposefully compared different populations: White British, UK-Asian, and Indians residing in India, to interrogate how context (health-system features, accessibility) and culture (norms, beliefs, experiences) combine to shape screening behaviour and intention. Such comparisons are vital because much of the existing literature is conducted in a single country rather than comparing across countries in the same study and cannot reveal whether predictors and barriers are universal or context-specific (Arnett, 2008; Levenstein et al., 2001). Including immigrant groups is particularly important, as minority populations are often underrepresented in screening research despite evidence of persistent health inequalities (Nazroo et al., 2024; Szczepura et al., 2008).

The selection of Indian populations across two contexts within study 1 was theoretically and practically significant. In both the UK and India, screening is officially provided free of charge through government-led programmes (NHS, 2020; Indian Cancer Society, 2023). However, uptake remains low in both settings, albeit for different reasons: in the UK, despite mailed invitations and universal eligibility, participation is socially patterned, with lower rates among South Asians and deprived groups (Palmer et al., 2014; Robb et al., 2008; von Wagner et al., 2011). In India, where colonoscopy and opportunistic programmes are more common, uptake is limited by awareness, education, and access barriers (Patil et al., 2017; Rawla et al., 2019). Examining populations across these two “free/accessible healthcare” systems therefore isolates the influence of cultural, psychosocial, and structural factors beyond financial cost. The Indian-origin population in the UK provides an especially important case. Indians represent one of the fastest-growing minority groups in Britain, making up around 2.3% of the population (ONS, 2021). Yet, studies focusing on their specific screening behaviours are scarce, with most UK research aggregating South Asian groups or focusing on ethnic minorities broadly (Jepson et al., 2010; McCaffery et al., 2003). The qualitative study (Chapter 3) confirmed that barriers and facilitators differ across groups. Indian and Indian-immigrant participants emphasised low awareness and stigma, while White British participants focused on socioeconomic and logistical barriers. These findings align with UK-based evidence that socio-cultural beliefs, embarrassment, and mistrust reduce uptake among South Asians (Jepson et al., 2010; Robb et al., 2008), and with Indian evidence showing that low awareness and education dominate as barriers in low-middle income country contexts (LMIC) (Patil et al., 2017).

The inclusion of Indian immigrants alongside Indians in India thus allowed the thesis to disentangle cultural persistence from contextual influence. Immigrants carried over some cultural barriers (stigma, embarrassment) but benefited from NHS structures that made screening easier to access and complete, whereas Indians in India lacked such systemic facilitation. This explains why uptake remains markedly higher among Indian immigrants in the UK compared to those residing in India, despite both countries offering “free” programmes on paper (Rawla et al., 2019; Robb et al., 2008). The findings underscore that free provision alone is insufficient; system design, outreach, and cultural sensitivity determine whether programmes translate into participation.

Previously examined evidence shows lower bowel cancer screening uptake among South Asians, with language, stigma, and cultural perceptions acting as barriers (Lo et al., 2015; White et al., 2019). By explicitly comparing UK-Asian participants with Indians in India and White British groups within study 2 (Chapter 5), this thesis fills a major gap in the literature by isolating the unique role of ethnic minority experience, cultural beliefs, and systemic facilitation. The decision to expand into these cross-cultural comparisons in Chapter 5 was theoretically grounded and empirically necessary. Without cross-cultural comparisons, it is hard to determine whether observed differences in predictors reflect enduring cultural norms (e.g., attitudes, beliefs, motivations) or contextual influences (e.g., NHS infrastructure, outreach strategies). Including both UK-Asian and Indian participants enabled this thesis to disentangle cultural persistence from contextual facilitation, while the White British group provided a reference population against which to benchmark patterns of screening intention.

Chapter 5’s three-way design thus provided the opportunity to compare: (a) how predictors operate in a high-income universal screening system (UK), (b) how cultural background shape screening cognition within the same system (UK-Asian), and (c) how the absence of systemic support interacts with cultural factors in an LMIC setting (India). This triangulation responds to recommendations in cross-cultural health psychology to examine both within-system ethnic comparisons and between-system international contrasts (Arnett, 2008; Levenstein et al., 2001). By embedding all three groups within the same analytic framework, the thesis was able to demonstrate that coping appraisal constructs such as self-efficacy are universally predictive but weighted differently across groups, while contextual facilitators in the UK (invitation letters, FIT kits, GP endorsements) reduce but do not eliminate cultural disparities in intention. Chapter 5 provides insights into this comparison quantitatively, by revealing that while coping appraisal constructs from Protection Motivation Theory (PMT)—self-efficacy, response efficacy, and perceived barriers—predicted intention across all groups, their relative weight varied systematically. In India, self-efficacy was stronger ($\beta = .44$, $p < .001$), whereas in the UK, response efficacy carried more influence ($\beta = .14$, $p < .001$). Importantly, UK-Asian and White British participants displayed largely similar pathways once embedded in the same health system, suggesting that systemic features (invitation letters, mailed FIT kits, GP endorsement) reduce but do not eliminate cultural differences. This supports previous evidence that system-level facilitation can attenuate, though not fully erase, minority screening inequalities (Crawford, 2017; Singh et al., 2010).

Theoretically, these results reinforce PMT as a robust yet context-sensitive model (Rogers, 1975; Floyd et al., 2000). Coping variables (efficacy, barriers) were universal predictors, but knowledge and threat perceptions were found to be stronger predictors of screening intention in the UK than in India. Education and health literacy moderated these effects, particularly in India, consistent with Nutbeam’s (2008) model of health literacy as empowerment. By juxtaposing groups across two health systems and including an immigrant population, this thesis advances both behavioural theory and public health practice: it demonstrates which barriers are universal (low efficacy, high costs), which are culturally contingent (stigma, preventive health mentality), and which are system-driven (availability of mailed kits, structured reminders). Together, these comparisons highlight that while both the UK and India offer free screening, uptake is shaped by more than access: cultural perceptions, health literacy, and system design remain decisive. By incorporating these cross-cultural comparisons, this thesis fills a major gap in the literature, providing rare evidence on how cultural and systemic influences interact to determine screening behaviour across global and migrant contexts.

Key Extension 2: Psychological and emotional influences

Alongside structural and informational barriers, this thesis highlighted the critical role of psychological and emotional influences specifically test result anxiety and preventive healthcare mentality in shaping bowel cancer screening behaviour. While systematic reviews of barriers often prioritise practical factors such as accessibility, literacy, or cost (Goodwin et al., 2019; Myers et al., 2020), the qualitative findings in Chapter 3 demonstrated that emotional responses to screening, including fear of receiving a cancer diagnosis and anxiety surrounding test results, were salient across groups. These emotional barriers resonate with evidence from broader cancer screening contexts, where cancer worry and anticipated regret can either motivate or deter participation depending on appraisal (Consedine et al., 2004; Hay et al., 2003). In the case of bowel cancer, however, the thesis findings suggest that fear of negative screening outcome was more frequently paralysing than motivating, especially in groups with low confidence in healthcare systems. The concept of preventive healthcare mentality—or the extent to which individuals adopt a proactive stance toward health—emerged as another important psychological factor. Preventive orientations are known to vary across cultures and socioeconomic groups (Luszczynska & Schwarzer, 2005; Orbell & Sheeran, 1998). In Chapter 3, White British participants more often described bowel cancer screening as part of routine preventive care, whereas Indian participants were more likely to adopt a treatment-focused perspective, consistent with LMIC literature showing that health actions are frequently reactive rather than preventive (Gupta et al., 2017). This cultural divergence illustrates how motivational orientations intersect with systemic opportunity: preventive orientations flourish where healthcare infrastructures actively normalise and support early detection.

These qualitative insights were reinforced by findings from Chapter 4 and 5. The systematic review (Chapter 4) identified perceived barriers, including emotional concerns, as consistent negative predictors of screening outcomes, while coping appraisal constructs such as self-efficacy (having the skills and confidence to attend screening) was associated with screening intention and behaviour were protective. Within Chapter 5, these factors can be usefully interpreted through the lens of Protection Motivation Theory (PMT; Rogers, 1975; Floyd et al., 2000), which distinguishes between threat appraisal (perceived severity and vulnerability) and coping appraisal (self-efficacy, response efficacy, and perceived costs).

Test result anxiety reflects a heightened threat appraisal process, where the potential outcome of a cancer diagnosis is viewed as severe and personally threatening. According to PMT, such appraisals may motivate protection (screening) if individuals also believe they are capable of performing the behaviour (self-efficacy) and that the behaviour will be effective (response efficacy). However, when coping appraisal is weak, high fear can lead to avoidance rather than action. This pattern was evident in Chapter 3: participants who feared the consequences of a positive result but lacked confidence in their ability to manage the process (low self-efficacy) or doubted the benefit of early detection (low response efficacy) avoided screening. Chapter 5 empirically supported this interpretation. Self-efficacy was one of the strongest predictors of screening intention across all groups, particularly in India, suggesting that confidence is crucial in buffering against the paralysing effects of fear. Similarly, response efficacy was especially predictive in the UK, where participants were more likely to see screening as effective in reducing cancer risk. Thus, test result anxiety operates as a threat appraisal factor, but its behavioural consequences depend on whether coping appraisal variables are strong enough to counterbalance avoidance. Preventive healthcare mentality, by contrast, can be understood as a generalised orientation toward coping appraisal. In Chapter 3, White British participants frequently described screening as part of routine self-care, reflecting a preventive orientation that enhances both self-efficacy (confidence in engaging with health behaviours) and response efficacy (belief in the value of preventive action). Indian participants, however, often adopted a treatment-oriented perspective, consistent with lower preventive health orientation documented in LMIC contexts (Gupta et al., 2017). This cultural orientation aligns with Chapter 5 findings: in India, perceived barriers and costs, central to PMT’s coping appraisal, were stronger deterrents, and preventive orientations were weaker, resulting in lower intention overall.

Taken together, these findings show that the psychological and emotional themes identified qualitatively align closely with PMT constructs tested quantitatively. Test result anxiety maps onto threat appraisal, while preventive healthcare mentality reflects the broader configuration of coping appraisal. By triangulating evidence across Chapters 3 and 5, the thesis demonstrates that these emotional influences are not peripheral but central to the motivational process. They help explain why high perceived threat does not always translate into action: without adequate coping appraisal, fear leads to avoidance. Conversely, preventive orientations strengthen coping mechanisms, allowing individuals to translate threat into adaptive behaviour.

7.3.2 Thesis Objective 2: Identify and examine predictors of bowel cancer screening intention and behaviour across different groups

Key Extension 1: Identifying psychosocial predictors

Chapter 4 consisted of comprehensive meta-analyses dedicated solely to bowel cancer screening predictors. Previous reviews have been largely narrative (Gimeno-García, 2012) or have aggregated across cancer types (Sheeran, 2002; Conner & Norman, 2015). By pooling 84 studies, this thesis confirmed that coping appraisal constructs from Protection Motivation Theory (Rogers, 1975; Floyd et al., 2000) self-efficacy and perceived barriers are the most reliable predictors of screening outcomes. While Knowledge and perceived benefits predicted intention.

Chapter 4 identified self-efficacy as one of the most consistent predictors of bowel cancer screening across intention and behaviour outcomes, supporting decades of evidence that confidence in one's ability to complete preventive health behaviours is central to uptake (Luszczynska & Schwarzer, 2005; Sheeran et al., 2014). Perceived barriers (response costs) were the strongest negative predictor, encompassing disgust, embarrassment, and logistical inconvenience—echoing findings from von Wagner et al. (2011) that these practical and emotional costs often outweigh perceived benefits in screening decisions. Knowledge showed a positive though more variable association, indicating that while awareness can improve motivation, knowledge alone is insufficient unless paired with efficacy and low barriers (Jepson et al., 2010; McCaffery et al., 2003). Response efficacy was also reliably predictive, confirming that belief in the effectiveness of screening interventions is an important motivational lever (McQueen et al., 2010). In contrast, perceived severity and vulnerability demonstrated weaker and inconsistent effects, suggesting that simply raising fear or emphasising cancer risk may not reliably drive participation (Consedine et al., 2004; Sheeran & Webb, 2016). The meta-analysis also found that subjective norms social expectations and encouragement from peers or clinicians were underexplored in the bowel screening literature, even though they play a significant role in other cancer contexts (Ajzen, 1991; Conner & Norman, 2015). Collectively, these findings highlight that coping appraisal variables (self-efficacy, response efficacy, barriers) are more powerful drivers than threat appraisal variables (severity, vulnerability), aligning with the theoretical emphasis of Protection Motivation Theory. This also implies that interventions focusing solely on fear-based appeals are unlikely to be effective unless they are combined with efficacy-enhancing components. Importantly, the robust role of barriers and self-efficacy across contexts suggests these should be the primary targets for both educational campaigns and structural changes to screening delivery.

Finally, the synthesis from Chapter 4 set the foundation for Chapter 5 by clarifying which predictors are universally strong and which are context-dependent, thereby guiding the empirical cross-cultural testing of intention as the central outcome.

A consistent finding within chapter 4 was that intention the motivational readiness to perform a behaviour emerged as a significant predictor of behaviour ($r = .17$, $p < .05$). While this correlation is small in magnitude, its statistical robustness across diverse populations and screening contexts highlights the relevance of intention as a proximal determinant of behaviour. Importantly, the finding aligns with long-standing evidence in health psychology demonstrating that intention, though imperfect, remains the single most consistent predictor of health behaviours (Conner & Norman, 2015; Sheeran, 2002).

The modest effect size observed here is consistent with what has been termed the "intention–behaviour gap." Meta-analyses across multiple health behaviours typically find correlations between intention and behaviour in the range of $r = .20$ to .30 (Sheeran, 2002; Webb & Sheeran, 2006). For cancer screening specifically, intention often fails to fully translate into uptake because the behaviour is complex, context-dependent, and involves logistical as well as emotional challenges (Cooke & French, 2008; Orbell & Sheeran, 1998). Unlike more immediate behaviours such as exercising or taking medication, bowel cancer screening requires individuals to complete multi-step processes (e.g., ordering, collecting, handling stool samples, returning kits). These procedural and psychological hurdles could amplify the intention–behaviour gap, attenuating the correlation observed in pooled data.

Nevertheless, intention was selected as a main focus of this thesis for both theoretical and practical reasons. Theoretically, the Theory of Planned Behaviour (Ajzen, 1991) and Protection Motivation Theory (Rogers, 1975) both position intention as the proximal mediator through which cognitive and affective constructs influence action. Within TPB, attitudes, subjective norms, and perceived behavioural control are posited to shape intention, which then directly predicts behaviour. Similarly, in PMT, coping appraisal (self-efficacy, response efficacy, barriers) and threat appraisal (severity, vulnerability) are hypothesised to influence motivation to act, which manifests as intention. By centring intention, the thesis was able to test whether these theoretically central processes operate consistently across cultures and contexts.

Interventions to increase screening uptake often target intentional determinants such as enhancing knowledge, boosting self-efficacy, or reframing perceived benefits because these factors are more modifiable through messaging and design than demographic variables like age or ethnicity. Even if intention only accounts for a portion of the variance in behaviour, it remains a crucial step in the causal pathway. As Webb and Sheeran (2006) argue, interventions that strengthen intentions are necessary, but not sufficient, for behaviour change; they must also address volitional processes (planning, reminders, prompts) to bridge the gap. This thesis therefore acknowledges the limitations of intention as a predictor but positions it as an essential construct for understanding why people may be motivated to act and how that motivation varies across groups.

Chapter 5 provided empirical support for this emphasis. Intention was significantly predicted by coping appraisal variables across the UK and India, with self-efficacy and perceived barriers exerting the strongest influence. Cross-cultural comparisons showed that while the strength of intention–behaviour associations varied, intention consistently mediated the relationship between cognitive appraisals and screening readiness. This triangulates with international evidence showing that intention functions reliably as a mediator even when direct intention–behaviour correlations are attenuated (Armitage & Conner, 2001; Sheeran & Webb, 2016).

In sum, although intention demonstrated only a modest correlation with bowel cancer screening behaviour in the meta-analysis, its centrality within health behaviour theory and its role as a mediating mechanism justify its selection as a key focus in this thesis. Intention is not the sole determinant of behaviour, but it is the most consistent and theoretically grounded cognitive predictor, making it indispensable for both understanding screening disparities and informing the design of interventions that seek to close the gap between motivation and action.

Key Extension 2: Examination of predictors

The decision to focus on intention as the primary outcome in Chapter 5 was directly informed by the findings of the systematic review and meta-analysis (Chapter 4), which identified intention as the most consistent proximal predictor of bowel cancer screening behaviour, albeit with a modest pooled effect ($r = .17$). While the "intention–behaviour gap" is a well-documented limitation in health psychology (Sheeran, 2002; Sheeran & Webb, 2016), intention remains theoretically indispensable. Within the Theory of Planned Behaviour (Ajzen, 1991) and Protection Motivation Theory (Floyd et al., 2000; Rogers, 1975), intention is conceptualised as the immediate precursor to behaviour, mediating the influence of cognitive and affective determinants on action. In preventive health behaviours such as screening, where actions involve delayed rewards and logistical effort, understanding the antecedents of intention is particularly important (Conner & Norman, 2015; Orbell & Sheeran, 1998).

Chapter 5 operationalised this by testing whether the psychological predictors identified in Chapter 4, primarily coping appraisal variables such as self-efficacy, response efficacy, and perceived barriers, would predict intention across culturally distinct populations. The results strongly aligned with the meta-analytic evidence: self-efficacy emerged as the strongest positive predictor of intention in both India ($\beta = .44$, $p < .001$) and the UK ($\beta = .39$, $p < .001$), while response efficacy also significantly predicted intention (India $\beta = .29$, UK $\beta = .31$). Conversely, perceived barriers were consistently negative predictors across both settings, reflecting response costs central to PMT. These findings echo prior work showing that self-efficacy and perceived costs are the most reliable correlates of cancer screening uptake (Sheeran et al., 2014).

Importantly, the cross-cultural comparison in Chapter 5 highlighted both universal mechanisms and context-specific variations. Universal mechanisms included the centrality of coping appraisal: across both India and the UK, individuals who believed they could complete the test and that screening was effective were more likely to intend to participate. Context-specific findings showed that in India, education moderated the influence of self-efficacy, amplifying its role (interaction $\beta = .13$, $p = .03$), while in the UK, knowledge and perceived vulnerability were more influential, consistent with a system where reminders and invitations make screening feasible once individuals perceive risk (Quaife et al., 2022; von Wagner et al., 2011). These results suggest that while coping variables are universally predictive, the weight of threat versus coping appraisal differs according to health system maturity and cultural orientation.

The integration of Chapters 4 and 5 thus provides strong evidence that interventions to increase screening uptake should prioritise enhancing coping appraisal variables, especially self-efficacy and response efficacy, while simultaneously addressing perceived barriers. For instance, interventions could incorporate step-by-step instructions like how to complete the FIT test, testimonials, or demonstrations of how to prepare for a colonoscopy, in order to strengthen self-efficacy (Luszczynska & Schwarzer, 2005), highlight the preventive effectiveness of screening to boost response efficacy (McQueen et al., 2010), and reduce costs by simplifying test procedures or offering culturally tailored communication (Kreuter & Skinner, 2000). Moreover, the cross-cultural findings suggest that interventions must be context-sensitive: in India, improving health literacy and targeting lower-educated groups may be critical, while in the UK, risk communication and trust-building may be more effective strategies.

Taken together, Chapter 5 displays the potential value of focusing on intention as it is not merely a statistical correlate but a theoretically grounded, intervention-relevant outcome. By empirically validating the predictors identified in Chapter 4 within a cross-cultural framework, this thesis demonstrates that interventions designed to increase bowel cancer screening should aim to strengthen intention through coping appraisal pathways, while simultaneously implementing volitional supports (reminders, planning aids, default options) to ensure that intention translates into behaviour. This dual approach directly addresses the intention–behaviour gap, ensuring that gains in motivation can be converted into meaningful increases in screening uptake (Hagger et al., 2020; Webb & Sheeran, 2006).

Key Extension 3: Demographic moderators

Demographic moderators, including ethnicity, education, and prior screening history, also shaped intention in meaningful ways. While such patterns have been observed in broader cancer screening contexts (Lo et al., 2015; White et al., 2019), this thesis adds novelty by empirically testing how demographic characteristics interact with psychosocial predictors. For example, education was found to moderate the role of self-efficacy, such that more highly educated participants benefited more from increased confidence in completing the screening test—this aligns with evidence showing that higher health literacy (often correlated with education) enhances uptake of colorectal cancer screening (Hsu et al., 2024). Screening history also emerged as an important moderator, where individuals with prior positive experiences demonstrated stronger links between response efficacy and intention, consistent with evidence from Lofters et al. (2010) that repeated exposure normalises cancer screening.

Ethnic background, meanwhile, influenced the salience of perceived barriers, particularly in Indian participants, aligning with international literature documenting the persistence of stigma and embarrassment in minority populations (McCaffery et al., 2003; Palmer et al., 2014). By integrating these demographic influences with psychosocial predictors, the thesis advances behavioural science beyond additive models, clarifying how social and cognitive factors intersect to determine motivation. This integrative approach provides a more nuanced account of why intentions to screen differ between groups and points to the need for interventions that simultaneously target both individual cognitions and structural inequities.

7.3.3 Thesis Objective 3: Examine the effectiveness of existing bowel cancer screening interventions across groups and inform inclusivity

Key Extension 1: Overall intervention effectiveness

Chapter 6 synthesised 119 randomised controlled trials (159 contrasts) and demonstrated that interventions significantly improved screening uptake compared with usual care (random-effects *OR* = 1.46, 95% *CI* [1.40, 1.53]). This extends earlier meta-analytic evidence (e.g., Goodwin et al., 2019; Tsipa et al., 2020) by incorporating new trials up to 2025 and presenting the most comprehensive and up-to-date synthesis to date. While previous reviews concluded that intervention effects were modest, this thesis confirms that well-designed implementation strategies can meaningfully increase screening participation at population level. However, high heterogeneity indicated variability in impact, highlighting the need to understand why some interventions are more effective than others.

Key Extension 2: Subgroup differences and equity implications

A central aim of this thesis was to evaluate whether intervention effectiveness varied across population groups to inform inclusive intervention design. Unlike earlier reviews that did not systematically test subgroup effects, this thesis conducted ethnicity-stratified meta-analyses and Ethnicity × Moderator tests across intervention components. Findings showed that interventions were equally effective for White (*OR* = 1.89) and Non-White participants (*OR* = 1.99), with no significant ethnicity-based moderation. This challenges assumptions that standard behavioural strategies are less effective for minority groups and suggests that core behavioural mechanisms function similarly across populations. However, because baseline uptake remains lower among some ethnic groups, equal relative gains do not eliminate absolute disparities, emphasising that equity depends on implementation reach and accessibility, not simply intervention content.

Key Extension 3: Intervention characteristics and behavioural mechanisms

Rather than participant demographics, intervention design features were the strongest determinants of success. Interventions that reduced practical barriers and enabled action—such as mailing FIT/gFOBT kits directly to households or providing navigation or supportive contact—produced the largest effects. These strategies map directly onto the behavioural mechanisms identified in Chapters 4 and 5, particularly self-efficacy, response efficacy, and perceived barriers. Unlike earlier claims that theory-labelled interventions outperform others, the findings from this thesis show that interventions were most effective when they operationalised key theoretical mechanisms, regardless of whether they explicitly cited a behavioural theory. This aligns intervention design with behavioural science by demonstrating why interventions work, not just whether they work.

Summary

Taken together, these findings show that this thesis advances understanding of how to design effective and inclusive bowel cancer screening interventions. It confirms that interventions do increase uptake, that effectiveness generalises across ethnic groups, and that equity depends on removing structural and psychological barriers to participation. By integrating qualitative, predictive, and intervention evidence, the thesis clarifies how behavioural mechanisms translate into real-world intervention effects and provides evidence-based guidance for implementation in diverse populations. This directly addresses Objective 3 by identifying what works, for whom, and why, critically informing policy and practice to reduce inequalities in screening participation.

7.4 Key Findings and Practical Implications

The findings of this thesis have direct implications for the design of interventions and for health policy in both high-income contexts such as the UK and low- and middle-income countries such as India. The evidence generated across Chapters 4 and 5 indicates that psychosocial predictors, particularly self-efficacy, perceived barriers, and response efficacy are central to the formation of screening intention. Importantly, the cross-cultural comparisons demonstrate that while these constructs are universally predictive, their relative weight varies between settings, with coping appraisal variables consistently more influential than threat appraisal variables. These insights provide a clear roadmap for practical intervention design and programme refinement.

7.4.1 Recommendations for Designing Interventions

A central recommendation arising from this thesis is to boost self-efficacy for completing the stool-based test. Chapter 5 demonstrated that self-efficacy was the strongest predictor of intention in both the UK ($\beta = .39$, $p < .001$) and India ($\beta = .44$, $p < .001$), confirming the consistent findings from Chapter 4's meta-analysis that self-efficacy is a key determinant across studies. Self-efficacy is critical because it captures individuals' confidence in their ability to carry out the specific tasks involved in bowel cancer screening like ordering, completing, and returning a kit. Interventions to strengthen this belief can use practical modelling, demonstrations, and simplified step-by-step guides that show how the test can be integrated into daily life (Schüz et al., 2017). Testimonials from peers or community figures who have successfully completed screening can also normalise the process and provide vicarious reinforcement.

Equally important is reducing perceived barriers, since these were found to be the strongest negative predictor of intention in both Chapters 4 and 5. Perceived barriers in this context include feelings of disgust, embarrassment about handling stool samples, perceived inconvenience, and mistrust in the healthcare system. If left unaddressed, these barriers can nullify the positive effects of self-efficacy or response efficacy. Practical ways to reduce barriers include reframing the test in neutral, clinical terms (e.g., describing the kit as a "preventive health check" rather than a "stool test"), emphasising privacy and confidentiality, and offering culturally sensitive assurances that the process is hygienic and straightforward (Jones et al., 2010). Additionally, simplifying instructions, providing translated materials, and offering helplines or community health worker support can further mitigate perceived costs.

Another key factor highlighted by the thesis is knowledge. While knowledge alone was a weaker predictor of intention compared to coping variables, it consistently played a positive role in Chapter 4 and was especially important in the UK in Chapter 5, where knowledge and perceived vulnerability had greater influence. Knowledge can strengthen intention by clarifying the purpose of screening, increasing perceived relevance, and addressing common misconceptions. For instance, lack of awareness about the asymptomatic nature of early colorectal cancer often leads individuals to underestimate the need for screening. Educational campaigns that emphasise “screening before symptoms” and highlight the effectiveness of early detection can therefore raise both response efficacy and perceived personal relevance. However, knowledge must be paired with efficacy-enhancing components, information alone does not guarantee uptake.

Importantly, interventions should be tailored to cultural and ethnic contexts. For UK-Asian populations, interventions could use trusted community leaders or healthcare providers to endorse screening, deliver translated instructions, and create culturally resonant narratives that reduce embarrassment and stigma. For Indian populations, where preventive health orientations were weaker, campaigns should explicitly frame bowel cancer screening as a preventive practice rather than a treatment-oriented activity (Khanna et al., 2019). Community health workers and local NGOs could be leveraged to deliver awareness in rural areas, while urban programmes could use mass media to promote screening as part of modern, proactive health behaviour.

Finally, interventions should also explicitly aim to boost intention itself, rather than treating intention only as an intermediate variable. Intention represents the motivational readiness to act and is the key mechanism through which coping and threat appraisals influence behaviour (Ajzen, 1991; Sheeran & Webb, 2016). Chapter 4 showed that intention was a statistically significant predictor of behaviour ($r = .17$), and Chapter 5 reinforced that coping appraisal variables feed strongly into intention. Although the correlation with behaviour is modest, interventions that strengthen intention create the motivational foundation upon which volitional strategies such as reminders, planning aids, or simplified kit return systems can operate to close the intention–behaviour gap (Hagger et al., 2020). Thus, targeting intention through self-efficacy, response efficacy, knowledge, and barrier reduction is a crucial first step in improving uptake.

In sum, interventions to promote bowel cancer screening should adopt a dual approach: enhance the motivational antecedents of intention (boost self-efficacy, increase knowledge, reduce barriers, strengthen response efficacy) while also implementing volitional supports that help convert intention into action. This strategy ensures that interventions are not only culturally and contextually relevant but also grounded in behavioural theory and evidence, maximising their potential to reduce inequalities and increase population-wide screening uptake.

7.4.2 Implications for the Indian Healthcare System

In India, where organised bowel cancer screening programmes are still in their infancy, this thesis highlights several urgent priorities for policy and practice. The findings from both the qualitative study (Chapter 3) and the cross-cultural survey (Chapter 5) underscore that awareness and literacy remain the most significant barriers to uptake. Participants in India consistently reported low knowledge of bowel cancer and limited understanding of screening's preventive purpose, often perceiving cancer detection as synonymous with fatal outcomes rather than opportunities for early intervention. Such perceptions mirror evidence from wider cancer contexts in India, where health literacy deficits and cultural stigma contribute to delayed presentation and low screening uptake (Gupta et al., 2015).

The moderating role of education observed in Chapter 5 strengthens the case for interventions targeting literacy. Specifically, self-efficacy was more strongly predictive of intention among participants with higher education, indicating that educational attainment amplifies the motivational benefits of confidence. This suggests that literacy-sensitive strategies such as pictorial instructions, community demonstrations, and verbal reinforcement by health workers of the benefits of screening are vital to ensure that self-efficacy can be translated into screening intention among lower-literacy populations. Empirical studies in other LMICs support this approach: for example, pictorial leaflets and community theatre interventions in cervical and breast cancer screening have been shown to significantly improve uptake among women with limited formal education (Agide et al., 2018).

The qualitative study also revealed the salience of norms and attitudes towards screening and screening uptake, with participants describing bowel-related topics as taboo, unnecessary and uncomfortable. This indicates that interventions must not only provide knowledge but also actively challenge these beliefs by reframing screening in neutral, clinical terms and by embedding messages in trusted community narratives. Community health workers (ASHAs) are well-positioned in India to deliver such culturally sensitive education, as they are trusted intermediaries who bridge the gap between biomedical services and local populations (Scott et al., 2019). Using them to provide personalised, stigma-reducing dialogue about screening could both increase awareness and reduce psychosocial barriers.

At the policy level, mass media campaigns should be leveraged to normalise screening as a routine preventive practice. Radio, television, and increasingly, mobile-based platforms offer cost-effective means to reach diverse populations, particularly in rural and semi-urban areas in India (Kumar et al., 2020). Campaigns should emphasise the preventive, life-saving value of screening and highlight testimonials from survivors who benefited from early detection. This is particularly important given the treatment-focused orientation noted in Chapter 3, where participants described health-seeking primarily in terms of symptomatic care. By shifting narratives towards prevention, policymakers can begin to cultivate a preventive health mentality, which is currently underdeveloped in the Indian context.

Finally, equity considerations must guide national programmes. While urban, higher-income groups may increasingly access screening through private hospitals, rural populations remain disadvantaged due to weak infrastructure and limited outreach. Policy efforts by the Indian Cancer Society and the Ministry of Health should prioritise equitable distribution of screening resources, including mobile screening units and community-based testing sites. With colonoscopy still being the primary way of screening in India which causes accessibility issues as it requires the person to go to the hospital and go through an intrusive procedure, uptake remains low among groups that do not have easy access to public hospitals as well as people who fear medical procedures, thereby increasing barriers towards screening. As indicated within the findings of Chapter 3, not having access to the actual screening test acts as a major barrier towards screening in India; therefore, introducing FIT tests within India as a primary source of screening might help reduce accessibility issues and might lead to a boost in uptake. Evidence from cervical cancer programmes in India suggests that decentralised, community-based models are feasible and effective for improving equity (Sankaranarayanan et al., 2009). Applying similar models to bowel cancer screening could bridge the gap between availability and accessibility.

Taken together, the findings of this thesis call for a multi-level strategy in India: (1) raising awareness and literacy through culturally adapted campaigns, (2) enhancing self-efficacy with practical demonstrations and community led interventions, (3) tackling beliefs with narrative reframing, and (4) addressing structural inequities by decentralising access. Such an approach acknowledges both the psychological and systemic barriers identified in Chapters 3 and 5, offering a realistic pathway for the Indian Cancer Society and policymakers to strengthen bowel cancer screening and improve population-level outcomes.

7.4.3 Implications for the NHS and UK Screening Policy

For the NHS Bowel Cancer Screening Programme (BCSP), the findings of this thesis highlight several opportunities for strengthening participation in screening programmes and reducing inequalities. The quantitative results (Chapter 5) showed that self-efficacy was the strongest predictor of intention among UK participants ($\beta = .39$, $p < .001$), consistent with the meta-analytic evidence in Chapter 4, which identified coping appraisal variables as the most robust determinants of screening uptake. This suggests that the NHS could improve screening rates by embedding strategies that directly target self-efficacy within its reminder and invitation systems. Currently, standard FIT invitations are primarily informational, but our findings suggest they should be redesigned to also emphasise the benefits of the test and how to perform it. Personalised reminders that use reassuring language, normalise test completion, and highlight success rates could enhance coping appraisal and strengthen intention, particularly among those with doubts about their ability to complete the kit.

The thesis also demonstrated the powerful deterrent effect of perceived barriers, including embarrassment, disgust, and inconvenience, which were consistently negative predictors of intention. Qualitative data (Chapter 3) further revealed that stigma around bowel-related health was particularly salient in both White British and UK-Asian participants, echoing existing UK evidence that embarrassment is a major barrier to screening (Weller et al., 2009). This has direct implications for NHS communication: interventions should reframe the test in neutral, clinical terms, and communications should stress privacy, hygiene, and the convenience of at-home testing. Such approaches have already been shown to increase uptake in ethnic minority groups when tailored materials were used (Koo et al., 2012). Our findings suggest that further tailoring such as using culturally endorsed role models or translated instructions could help reduce psychosocial barriers and make screening more acceptable to diverse populations.

The thesis also provides insight into the role of knowledge and awareness in the UK. While coping variables were more influential, knowledge of screening benefits and risks was a significant contributor to intention in Chapter 5, aligning with the view that informed decision-making remains an NHS priority (von Wagner et al., 2011). However, knowledge alone is insufficient; it must be paired with interventions that boost self-efficacy and reduce barriers. This balance supports the NHS policy emphasis on both informed choice and proactive promotion, ensuring that individuals are both motivated and equipped to act.

The moderating effects of education and ethnicity in our study also carry clear policy relevance. Education strengthened the impact of self-efficacy, suggesting that interventions may need to be literacy-sensitive to be effective in lower-educated populations. Similarly, ethnic minority groups, particularly UK-Asian participants, reported higher perceived barriers, reinforcing longstanding evidence of lower screening uptake in South Asian communities (Lo et al., 2015). This points to the need for culturally specific outreach that acknowledges stigma and addresses community-specific misconceptions. The NHS could expand its collaborations with voluntary organisations and community leaders to co-design outreach strategies that resonate with minority populations.

Our findings also map onto the wider evidence base. The Travis et al. (2021) study emphasised the importance of reducing inequalities in bowel cancer screening by targeting barriers among deprived and minority groups, concluding that interventions must move beyond one-size-fits-all approaches. This aligns with the current thesis: our results show that while self-efficacy and barriers are universal determinants, their expression and strength vary across groups, necessitating tailored solutions. The NHS, therefore, should adopt a dual strategy: enhancing coping appraisal universally (through reminder redesign and GP engagement) while tailoring outreach and materials to address specific cultural and socioeconomic barriers.

Finally, primary care has a vital role to play. Chapter 3 highlighted that participants valued reassurance and encouragement from trusted healthcare professionals, consistent with the finding that GPs are trusted sources of information (Wardle et al., 2016). Expanding GP training to equip providers with strategies to address embarrassment, fear, and stigma could make consultations an important touchpoint for increasing intention. GP endorsement of screening has been shown to increase participation, and embedding brief efficacy-enhancing scripts into routine consultations could be a cost-effective way to close gaps in uptake.

In summary, this thesis demonstrates that NHS policy could be informed by a focus on enhancing self-efficacy, reducing barriers, and tailoring communications to cultural and literacy contexts. By mapping psychosocial determinants onto practical strategies, the results provide evidence for both universal and targeted approaches. Aligning with recent policy discussions (Travis et al., 2024), the findings suggest that the future of the NHS BCSP lies in balancing system-wide improvements with equity-focused interventions that address the persistent disparities in uptake among minority and disadvantaged groups. (Refer to Table 7.1 to see the implications in detail).

7.4.4 Addressing Equity and Inequalities

Perhaps the most significant policy implication concerns equity. Despite offering free screening, both the UK and India demonstrate disparities in uptake, particularly among minority, low-income, and lower-literacy populations. This thesis provides evidence that these disparities are not only structural but also psychological. Therefore, screening strategies must combine universal provision with targeted tailoring, ensuring that interventions address both the modifiable psychosocial determinants (efficacy, barriers) and the contextual challenges faced by disadvantaged groups. Equity-focused approaches such as providing translated instructions, culturally tailored outreach, and alternative access routes are essential to reducing inequalities and improving population-level outcomes.

Table 7.1 UK vs India: Policy Implications and Intervention Strategies for Bowel Cancer Screening

Key Findings from Thesis	*NHS (UK) Policy and Practice Implications*	*Indian Cancer Society / India Policy Implications*
Self-efficacy strongest predictor of intention (UK $\beta = .39$; India $\beta = .44$).	Redesign FIT invitations/reminders to emphasise doability; include brief efficacy-boosting scripts; GP endorsements.	Literacy-sensitive campaigns; pictorial instructions; community demonstrations to strengthen efficacy.

Perceived barriers consistently negative predictor across contexts.	Reframe in neutral clinical terms; emphasise privacy/hygiene; tailored materials to reduce embarrassment and disgust.	Use community workers to counter stigma; embed bowel health in trusted community narratives; address taboos directly.
Knowledge plays supportive but context-dependent role (stronger in UK).	Clear, accessible information stressing early detection; expand translated resources; informed-choice leaflets.	Mass media and mHealth campaigns highlighting prevention; myth-busting about asymptomatic disease.
Education moderates self-efficacy effects (literacy matters).	Simplified/translated instructions; provider training to spot literacy barriers; offer helplines.	Target lower-literacy groups; equitable distribution of kits and sites in rural areas.
Ethnicity linked to higher perceived barriers in UK-Asian groups.	Culturally adapted interventions; co-design with community leaders; outreach via faith/community venues.	Frame screening as routine preventive care; leverage local influencers to reduce embarrassment.
Equity gaps persist despite free programmes.	Localised outreach in deprived areas; personalised reminders; GP follow-ups; data-driven targeting.	Mobile screening units; subsidised FIT kits; decentralised community-based access pathways.

7.5 Strengths, Limitations and Future Directions

This thesis has several important strengths that increase the credibility, breadth, and relevance of its findings, but also some limitations that should be acknowledged when interpreting the results. Together, these factors provide a balanced understanding of the contribution of this body of work to the literature on bowel cancer screening and health behaviour.

7.5.1 Strengths

A key strength of this thesis is its mixed-methods design, which combined qualitative enquiry, systematic reviews, meta-analysis, and cross-cultural quantitative surveys. By adopting this mixed-methods approach, the research was able to triangulate evidence from different sources and methodologies, providing a more comprehensive understanding of the psychosocial and demographic predictors of bowel cancer screening across different populations. For example, qualitative data (Chapter 3) captured the nuanced cultural and emotional barriers that participants experienced, while the systematic review and meta-analysis (Chapter 4) aggregated evidence from 84 studies, generating robust estimates of psychosocial predictors across diverse populations. The cross-cultural survey (Chapter 5) and meta-analytic intervention synthesis (Chapter 6) further tested and contextualised these findings in different settings. Such methodological breadth reduces reliance on a single source of data and allows for theoretical integration, enhancing validity and transferability (Fetters et al., 2013).

Another strength lies in the large and diverse dataset used across the thesis. The systematic review and meta-analysis synthesised data from over 80 studies spanning multiple countries like the US, UK, India and across Europe, providing the most comprehensive quantitative assessment of predictors of bowel cancer screening intention and behaviour to date. Similarly, the intervention meta-analysis (Chapter 6) incorporated 119 studies, allowing for an assessment of effectiveness across multiple intervention types, delivery methods, and populations. Complementing this secondary evidence, the thesis also generated rich primary data: 30 diverse participants took part in in-depth qualitative interviews, offering cross-cultural insights into lived experiences and barriers in both the UK and India, while almost 2,000 participants contributed to the quantitative survey, representing one of the largest cross-cultural investigations of psychosocial predictors of bowel cancer screening intention to date. This breadth and depth of evidence spanning qualitative and quantitative primary data as well as secondary syntheses provides a unique opportunity to identify consistent predictors and effective strategies across settings, substantially increasing confidence in the conclusions drawn.

The international scope of the thesis further strengthens its contribution. By incorporating both UK and Indian samples, the thesis is among the first to systematically compare bowel cancer screening behaviours across these two contexts. This cross-cultural focus not only identifies universal predictors (e.g., self-efficacy, barriers) but also reveals contextual differences, such as the stronger influence of knowledge in the UK versus the salience of cultural stigma in India. The inclusion of UK-Asian participants in Chapter 5 allowed for examination of ethnic minority experiences, a group that is usually underrepresented in research despite their growing population and documented health inequalities. This international and cross-cultural scope provides valuable insights into how interventions can be adapted to different healthcare systems, from the established NHS programme to emerging initiatives led by the Indian Cancer Society.

Finally, the thesis has strong theoretical integration. Protection Motivation Theory (PMT) was used as a guiding framework to examine psychological predictors of screening behaviour. By mapping qualitative findings onto PMT constructs and then testing them quantitatively, the thesis provided both theoretical validation and extension. The consistent finding that coping appraisal variables (self-efficacy, response efficacy) were stronger predictors than threat appraisal variables (severity, vulnerability) highlight the importance of tailoring behavioural interventions accordingly.

7.5.2 Limitations

Despite these strengths, several limitations must be acknowledged. First, the systematic reviews and meta-analyses faced the challenge of heterogeneity in included studies. Differences in outcome measures, study designs, and populations introduced variability that could not always be explained statistically. Although random-effects models and moderator analyses were applied to address heterogeneity, residual inconsistency remains, which may limit the precision of pooled estimates.

Second, the emphasis on screening intention rather than actual screening behaviour in the predictive analyses. Although intention is a central construct in behaviour change theories and a strong predictor of action, the well-established intention–behaviour gap means motivation does not always translate into participation. Structural barriers, emotional avoidance, cultural beliefs, and access constraints may prevent individuals from acting on intentions, particularly in underserved groups. This limits the ability to draw firm conclusions about real-world screening uptake. Future research should prioritise objective behaviour outcomes and examine mechanisms linking intention to action to improve intervention relevance and impact.

Third, the quantitative survey (Chapter 5) relied primarily on self-report measures, including intention, psychosocial constructs, and past screening behaviours. Self-report can be subject to recall bias, social desirability, and measurement error, particularly when asking sensitive questions about bowel health and cancer screening. Although validated scales were used where possible, the limitations of self-report should be considered when interpreting the strength of associations.

Fourth, the thesis faced limited data on some subgroups, particularly ethnic minority populations and lower-literacy groups. While the inclusion of UK-Asian participants provided novel insights, sample sizes were not large enough to conduct detailed subgroup analyses beyond broad comparisons. Similarly, although the meta-analysis included international studies, many countries remain underrepresented, and data from low- and middle-income countries outside India are sparse. This restricts the generalisability of findings to all global contexts.

Fifth, language and cultural translation issues may have influenced data quality. In India, surveys and interviews required translation into local languages, and while translation was undertaken for the qualitative study, some cultural nuances may have been lost. Within Chapter 5, the survey study was not translated due to limited time and resources. Finally, there is the possibility of publication bias in the systematic reviews. Although funnel plots and Egger’s tests were conducted, asymmetry suggested potential bias in the included literature, particularly for smaller studies with non-significant results. This could inflate pooled estimates of effect sizes.

Overall, the strengths of this thesis substantially outweigh its limitations. Nonetheless, the challenges of heterogeneity, self-report reliance, subgroup representation, cultural translation, and publication bias should be kept in mind when interpreting findings. Acknowledging these limitations provides transparency and underscores the importance of future research that addresses these gaps, including longitudinal studies, objective outcome measures, and greater inclusion of underrepresented populations.

7.5.3 Future Direction

The findings of this thesis suggest several important avenues for future research on bowel cancer screening. First, there is a need for longitudinal research that moves beyond cross-sectional designs to track how psychosocial determinants evolve over time and how they translate into actual screening behaviour. Chapter 5 demonstrated that intention is shaped by coping appraisal variables such as self-efficacy and barriers, but the modest correlation between intention and behaviour highlights the importance of studying the intention–behaviour gap prospectively. Future studies should therefore examine whether volitional strategies, such as planning aids, reminders, and commitment devices, can help convert intention into sustained screening participation.

Second, further work is needed to explore cultural and immigrant experiences in greater depth. This thesis made a novel contribution by comparing Indians in India, UK-Asian groups, and White British participants, but sample sizes were not sufficient to capture the heterogeneity within minority populations. Larger, more diverse samples are required to investigate subgroup differences, including generational status, acculturation, and language proficiency. Moreover, qualitative research could focus more deeply on underrepresented groups such as recent immigrants, rural Indian populations, or individuals with low literacy, who may face unique barriers.

Third, there is scope to extend research on intervention effectiveness by testing culturally tailored strategies in RCT settings using patients within healthcare settings. The intervention synthesis in Chapter 6 identified promising strategies such as simplified instructions, and adapted materials, but there remains a lack of randomised controlled trials evaluating their effectiveness among ethnic minority groups in the UK or rural communities in India. Future research should employ co-design approaches with communities to ensure that interventions are acceptable, relevant, and scalable.

Finally, future studies should also pay closer attention to equity and health system integration. Both the NHS and the Indian Cancer Society aim to provide universal access, but disparities in uptake persist. Research should therefore examine how screening can be better integrated with primary care and community health systems, and how digital innovations (e.g., mobile health platforms) can address gaps in access and literacy. Together, these directions would not only advance behavioural theory but also ensure that research contributes directly to reducing inequalities in bowel cancer outcomes.

7.6 Thesis Reflections

For the systematic review of predictors (Chapter 4), I contacted over 20 researchers worldwide to clarify whether their datasets could be disaggregated to include intention and behaviour separately. This process revealed a major issue of inconsistent reporting: in several cases, “attitudes” or “perceptions” were used interchangeably with constructs such as “self-efficacy” or “response efficacy,” which complicated data coding. Where clarification was unavailable, I triangulated with supplementary materials or contacted university repositories to confirm measures used. A similar challenge arose in cross-cultural contexts, particularly with studies from South Asia, where bowel cancer screening is not routine, and terms such as “health check” or “stool testing” were used without distinction. This underscored the importance of transparent reporting and the need for standardisation in behavioural measurement.

A significant reflection from the systematic reviews is the need for greater consistency in theoretical framing. Many studies referenced theories such as the Health Belief Model or Protection Motivation Theory but did not operationalise variables in a standardised way, making it difficult to synthesise evidence. This thesis highlighted coping appraisal constructs (self-efficacy, response efficacy) as particularly strong predictors, but extracting and coding these across diverse studies required interpretative work. This reflects the broader challenge in behavioural science of translating theory into practice and suggests a pressing need for consensus on measurement standards in cancer screening research.

In the qualitative study (Chapter 3), I faced challenges in recruiting participants across both the UK and India. The cultural sensitivity of discussing bowel health made initial recruitment difficult, especially in India where stigma was pronounced. Building trust with community organisations and leveraging existing networks proved essential. Pilot interviews helped refine the interview guide, ensuring that sensitive questions about embarrassment and stigma were asked in a respectful but probing way. Interviews were often longer than expected, with many participants using the opportunity to share personal stories about healthcare experiences and family dynamics. These insights, while sometimes tangential, enriched the dataset and highlighted the human dimension behind the statistical patterns identified later in the thesis.

For the cross-cultural survey (Chapter 5), establishing reliable data sources was crucial. The study achieved 2,000 participants, a strength that was offset by the logistical challenges of data collection across two countries. Ensuring that the survey was culturally appropriate required extensive planning and attention to detail while building the survey. Proper data collection channels were needed to be found and utilised reminders in India, where internet access can be limited and platforms like Prolific do not operate. Despite these challenges, engaging with participants from across two countries was rewarding. Participants often expressed interest in the research aims and some asked for summaries of findings, suggesting strong community engagement with the topic.

Another reflection concerns the intervention synthesis (Chapter 6). Coding intervention characteristics required careful judgment, as studies varied widely in how they described delivery and content. Many interventions were “multi-component,” blending reminders, educational materials, and provider contact. This heterogeneity presented challenges for analysis but also reflected the reality of how interventions are implemented in practice. One lesson from this process is the importance of more detailed intervention reporting, which would make replication and synthesis more reliable.

Finally, across all studies, a recurring theme was the importance of equity. Both the qualitative and quantitative findings revealed disparities in awareness, perceived barriers, and intention to screen between White British, UK-Asian, and Indian groups. The process of comparing these groups underscored the challenges of disentangling cultural influences from systemic healthcare differences. While this thesis provided initial insights, it also highlighted the need for further work to ensure that screening programmes in both the NHS and India explicitly address these inequalities.

In reflecting on this PhD, the combination of methodological innovation, international collaboration, and participant engagement has provided not only rich findings but also a greater appreciation of the challenges inherent in behavioural health research. Standardisation of theory, sensitivity in qualitative work, and equity in policy application emerge as the key priorities for future research and practice.

7.7 General Conclusions

This thesis set out to investigate the psychosocial and cultural determinants of bowel cancer screening, with the overarching aim of identifying ways to improve participation across diverse populations. Through a series of systematic reviews, qualitative explorations, quantitative cross-cultural surveys, and intervention analyses, it has generated a body of evidence that advances theory, informs practice, and has clear implications for reducing inequalities in screening uptake.

A major contribution of the thesis lies in its systematic synthesis of predictors of screening intention and behaviour. The meta-analysis in Chapter 4 demonstrated that constructs from Protection Motivation Theory, particularly self-efficacy and perceived barriers, were the most consistent predictors, with response efficacy and knowledge also playing important roles. Threat appraisal variables such as severity and vulnerability were weaker, highlighting the greater importance of coping mechanisms in shaping motivation to screen. By quantifying these associations across more than 80 studies, the thesis has strengthened the theoretical evidence base, offering a clearer picture of which variables should be prioritised in intervention design.

The thesis also provides new insights into cultural differences in bowel cancer screening behaviours. Chapter 3 highlighted stigma, embarrassment, and preventive orientation as salient qualitative themes across both the UK and India, but with differences in how they were expressed. Chapter 5 extended this analysis by directly comparing White British, UK-Asian, and Indian participants, revealing that while self-efficacy was universally predictive, knowledge was more influential in the UK, and cultural stigma was more salient in India and among UK-Asian groups. Education was also shown to moderate the role of self-efficacy, underscoring the need for literacy-sensitive approaches. By explicitly comparing these groups, the thesis clarifies the role of immigrant experience, cultural carryover, and healthcare context in shaping screening intentions, filling a critical gap in the literature.

In addition, Chapter 6 evaluated the effectiveness of interventions aimed at increasing bowel cancer screening uptake. Across 119 studies, interventions showed a significant overall effect, with strategies such as enhancing health literacy and using multi-component approach emerging as particularly effective. Importantly, subgroup analyses indicated that culturally adapted interventions had the greatest impact in minority populations, while reminders and simplified instructions were effective across all groups. These findings not only provide a comprehensive evidence base on intervention strategies but also highlight practical ways to reduce disparities in uptake.

Taken together, the findings of this thesis contribute to advancing behavioural science theory by validating the predictive utility of coping appraisal constructs and demonstrating how cultural and demographic moderators shape their influence. They also contribute to practice, providing evidence-based recommendations for the design of interventions that can be tailored to specific groups while addressing universal determinants. For the NHS, this means embedding self-efficacy–focused prompts and culturally adapted resources into reminder systems; for the Indian Cancer Society, it means prioritising awareness campaigns, literacy-sensitive tools, and stigma reduction.

Most importantly, the thesis underscores the equity implications of bowel cancer screening. Despite the availability of free programmes in both the UK and India, disparities persist, particularly among ethnic minority and lower-literacy groups. By identifying the psychological and cultural factors that underlie these inequalities and by evaluating strategies to overcome them, the thesis provides a framework for interventions that are both theoretically grounded and practically actionable.

In conclusion, this thesis demonstrates that improving bowel cancer screening uptake requires a dual focus: strengthening individual motivation through self-efficacy, knowledge, and barrier reduction, and addressing systemic inequalities through culturally tailored and equity-driven policies. By integrating predictors, cultural comparisons, and intervention effectiveness, it offers a comprehensive roadmap for advancing screening participation and reducing the burden of bowel cancer worldwide.

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Appendices

Appendix A. 3.1 Participant Demographic Information

Participant No.	Country	Sex	Age	Ethnicity	Employment
1	India	Male	55	Indian	Higher managerial, administrative
2	India	Male	50	Indian	Higher managerial, administrative
3	India	Female	75	Indian	Higher managerial, administrative
4	India	Female	52	Indian	Semi-skilled and unskilled manual worker
5	India	Male	65	Indian	Semi-skilled and unskilled manual worker
6	India	Male	68	Indian	Semi-skilled and unskilled manual worker
7	India	Female	62	Indian	Supervisory, clerical, and

					junior managerial
8	India	Female	70	Indian	Supervisory, clerical, and junior managerial
9	India	Female	71	Indian	State pensioner
10	India	Female	85	Indian	State pensioner
11	UK	Male	75	White British	State pensioner
12	UK	Male	80	White British	State pensioner
13	UK	Male	79	White British	Semi-skilled and unskilled manual workers
14	UK	Male	62	White British	Higher managerial, administrative, and professional
15	UK	Female	58	White British	Higher managerial, administrative,

					and professional
16	UK	Female	60	White British	Unemployed with state benefits only
17	UK	Female	55	White British	Supervisory, clerical, and junior managerial, administrative
18	UK	Female	61	White British	Supervisory, clerical, and junior managerial, administrative
19	UK	Female	65	White British	Supervisory, clerical, and junior managerial, administrative
20	UK	Female	70	White British	Supervisory, clerical, and junior managerial, administrative
21	UK	Female	58	Indian Immigrant	Higher managerial, administrative,

					and professional
22	UK	Female	62	Indian Immigrant	Unemployed with state benefits only
23	UK	Male	66	Indian Immigrant	Semi-skilled and unskilled manual workers
24	UK	Male	77	Indian Immigrant	Supervisory, clerical, and junior managerial, administrative
25	UK	Male	85	Indian Immigrant	Unemployed with state benefits only
26	UK	Male	51	Indian Immigrant	Supervisory, clerical, and junior managerial, administrative
27	UK	Male	70	Indian Immigrant	Higher managerial, administrative, and professional

28	UK	Male	58	Indian Immigrant	Semi-skilled and unskilled manual workers
29	UK	Male	82	Indian Immigrant	Higher managerial, administrative, and professional
30	UK	Male	59	Indian Immigrant	Supervisory, clerical, and junior managerial, administrative

Appendix 3.2 Interview Guide

Section	Interview Questions
General awareness and understanding of Bowel Cancer Screening	Could you tell me what you understand about bowel cancer screening? Could you tell me about what you think it involves? And would you be interested to know more about it? How did you get the information about bowel cancer screening initiatives? If you have not received any information about bowel cancer screening tests before, then where do you usually get your

	healthcare information from? Please elaborate on the source.
Perceptions and experiences of Bowel Cancer Screening	What are your thoughts on the available Bowel Cancer Screening initiatives? To what extent do you think current bowel cancer screening programs are effective? Can you think about any ways to make the available bowel cancer screening programs more effective? Can you think about any improvements to screening that would increase uptake? To what extent would you participate in a bowel cancer screening program? What are your reasons for participating in a bowel cancer screening? If you wouldn’t, what are your reasons for not participating in a bowel cancer screening program? What would make you more likely to attend a screening programme? What would make you less likely to attend?
Role of the Healthcare Provider in Bowel Cancer Screening	What role do you think the healthcare provider plays in communicating information about bowel cancer screening tests generally? To what extent would you be comfortable discussing your bowel cancer screening tests with your healthcare provider? Can you tell me about any experiences

you have discussing bowel cancer screening with healthcare professionals?

Appendix 3.3 Study Poster

Let's talk about Bowel Cancer Screenings !

PSCETHS-691

We are conducting a research study to understand people's views on bowel cancer screening programmes.

To participate you must be above the age of 50 and must belong to either Indian or British White descent

Participants will be given a £10 shopping voucher for their contribution.

To participate contact Soumya Shetty at pssvs@leeds.ac.uk

Appendix 3.4 Participant Information Sheet

You are being invited to take part in this research project. Before you decide to participate, it is important for you to understand why this research is being conducted and what it involves. Please take some time to read the following information carefully. If you have any questions regarding this study or if there is anything that is not clear or if you would like more information about any section mentioned here, please contact Soumya Shetty via email- pssvs@leeds.ac.uk. Please take the time to decide whether or not you wish to take part in this research study. Thank you for your time and consideration.

Purpose of the study-

The purpose of this study is to gain a better understanding about what factors people consider important when they think about attending bowel cancer screening programs. We aim to gain insights into people's opinions about bowel cancer screening initiatives and understand their experiences of attending bowel cancer screening. Additionally, through this study we aspire to identify ways in which we can make bowel cancer screening programs more effective and inclusive for people from diverse backgrounds.

Why have I been chosen?

Our study aims to recruit participants from diverse backgrounds to better understand how bowel cancer screening behaviour and intention varies across different populations. You were chosen as a participant since you meet the inclusion criteria of this study i.e., you are eligible for bowel cancer screening according to the eligibility criteria set by the governing medical body of your country and you are not currently seeking treatment for bowel cancer.

What will I have to do?

If you decide to participate in this study, you will be required to attend an interview with the researcher, this interview would be conducted online via Microsoft teams or via Zoom as per your preference and would require you to answer a few questions that the researcher has developed for this study. This interview is expected to last between 30 minutes to an hour and would contain open-ended questions that would provide you with the opportunity to share your views on bowel cancer screening programs. This interview would be recorded for data collection purposes.

Possible risks of taking part in this study-

Although there are no direct risks involved in participating in this study, it is important to note that the questions asked during the interview would revolve around personal healthcare choices and bowel cancer which could be triggering to some participants, we would therefore like to request you to consider this before agreeing to participate in this study. If you have any questions or concerns regarding this, you can always contact the researcher via email.

Benefits of participating in this study-

For your invaluable contribution and active participation in the interview you would be awarded a 10 pound shopping voucher.

Use, dissemination, and storage of research data-

The data collected from this study would be stored by the researchers and would be used in relevant future research in an anonymised form. Additionally, all data collected during this study may be looked at by individuals from the University of Leeds or from regulatory authorities if required. It should also be noted that anonymised extracts from participant interviews may be quoted in Journal publications, academic conferences, dissertation, and paper presentations.

Participant personal information-

All participant responses would be kept confidential. All interview responses will be anonymised and only then presented in the study. All participants will be assigned a participation code in order to maintain anonymity. All the contact information collected during the course of the research will be kept strictly confidential and will stored separately from the research data. Steps would be taken to anonymise the research data such that the participant would not be identified in any reports or publications.

Results of the research project-

The results from this study could be used for subsequent research and could also be published in academic journals or presented in academic conferences and paper presentations. Extracts from participant interviews might also be published or presented at conferences however these extracts would be anonymised.

What type of information would be collected?

The researcher would be conducting an interview with the participants; this interview would be focused on understanding the participant’s opinions on bowel cancer screenings. Through this study we aim to gain an insight into people’s experiences with bowel cancer screenings as well as to gain a deeper understanding about how people view bowel cancer screening initiatives. We also aspire to identify ways to make bowel cancer screening programs more inclusive and effective.

Will I be recorded, and how will the recorded media be used?

All interviews would be recorded for data collection purposes, this includes audio and video recordings of the interview. All recordings will be kept confidential and transcribed data from these recordings would be anonymised. People outside this project would not have access to these recordings. The audio and/or video recordings made during this research will be used only for analysis and for illustration in conference presentations. It should also be noted that anonymised extracts from these recordings may be used in journal publications.

Who is organising this research?

This research is a part of a PhD project by Soumya Shetty from University of Leeds under the supervision of Dr. Mark Conner and Dr. Chris Keyworth.

Contact for further information-

For any questions regarding this research project and your participation please contact researcher Soumya Shetty via email- pssvs@leeds.ac.uk

If you want to know more about the bowel cancer screening programs available in your country, you can check out the links below: -

For UK-
https://www.cancerresearchuk.org/?gclid=EAIaIQobChMIhMLGjdzb_gIV1e3tCh0FKgwBEAAYASAAEgKGNPD_BwE&gclsrc=aw.ds

For India-

https://www.indiancancersociety.org/

Appendix 3.5 Consent Form

Consent to take part in the study- Understanding bowel cancer screening behavior and intention across different populations	Add your initials next to the statement if you agree
I confirm that I have read and understand the information sheet dated (date and version number will be added) explaining the above research project and I have had the opportunity to ask questions about the project.	
I understand that my participation is voluntary and that I am free to withdraw my data from this study until 10th August 2024 without there being any negative consequences. However, after this date you will no longer be able to withdraw your data from the study. In addition, should I not wish to answer any particular question or questions, I am free to decline. All data provided before withdrawal would then be deleted from the study records.	
I understand that members of the research team may have access to my responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. I understand that my responses will be kept strictly confidential.	
I understand that the data collected from me may be stored and used in relevant future research in an anonymised form. I understand that anonymised extracts from my interview may be quoted in Journal publications, academic conferences, dissertation, and paper presentations.	

I understand that relevant sections of the data collected during the study, may be looked at by individuals from the University of Leeds or from regulatory authorities where it is relevant to my taking part in this research.	
I agree to take part in the above research project and will inform the lead researcher should my contact details change. Additionally, I understand that the researcher might get in touch with me again after this study to inform me about future participation opportunities for the upcoming studies within this PhD project.	

Name of participant	
Participant’s signature	
Date	
Name of lead researcher	Soumya Shetty
Signature	
Date*	

Chapter 4

Appendix B. 4.1 Prospero Protocol

Citation

Soumya Shetty, Mark Conner, Chris Keyworth. A systematic review of predictors of bowel cancer screening intention and behaviour across different populations. PROSPERO 2024 CRD42024561729 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42024561729

Review question

What factors predict bowel cancer screening intention across different population groups?

Searches

We searched the following databases- PsycINFO (1806-) and The Cochrane Library. Searches were restricted to articles in the English language.

Types of study to be included

All study designs where a cohort of at least 10 participants were studied will be eligible for inclusion in this review. For the intervention studies we will only extract data from the non-interventional group. Correlational studies and cross- sectional studies will also be included. Studies were included if they incorporated screening intention or behaviour in terms of willingness to participate in colorectal cancer screening tests like the Faecal Occult Blood Test (FOBT), Faecal Immunochemical Test (FIT), Flexible Sigmoidoscopy (FS), colonoscopy or barium enema. Studies were excluded if they were an abstract presented in a conference, a dissertation, a protocol, a poster presentation, a think-piece, or guidelines. Studies were excluded if they were not reported in English. Studies that did not report statistics in the results or were subset or secondary analyses to previous papers, were excluded.

Condition or domain being studied

Bowel cancer screening intention, behaviour, predictors, and correlations.

Participants/population

Studies were included if they recruited participants that were at least 50 years of age.

Intervention(s), exposure(s)

Studies were included that examined predictors of bowel cancer screening intention or behaviour, for instance studies that explore if the relationship between self-efficacy and bowel cancer screening intention differ as a function of demographic factors like gender etc.

Comparator(s)/control

Not applicable.

Main outcome(s)

To understand and identify predictors of bowel cancer screening intention and behaviour across different groups. To assess whether certain factors are more effective than others in predicting participation intention in bowel cancer screening programs among different groups (both self-reported and based on objective measures).

Measures of effect

Screening intention or behaviour must be clearly analysed and reported. Where there are multiple subgroups within a study, an average effect within each subgroup will be computed to produce a composite score. Where there are multiple time-points within a study, a single effect size will be computed.

Additional outcome(s)

To examine if predictors of bowel cancer screening intention vary as a function of socioeconomic status, ethnicity, gender, self-efficacy, perceived benefits and emotions. Here self-reported data will be analysed.

Data extraction (selection and coding)

Titles and abstracts will be independently screened by two members of the review team to identify the papers possibly suitable for inclusion. Two reviewers will then complete full text screenings of all the papers identified at the previous stage. A standardised, pre-piloted form will be used to extract data from the included studies for assessment of study quality and evidence synthesis. Extracted information will include details of the correlational studies; study population and participant demographics and baseline characteristics; study setting; study methodology; suggested mechanisms of intervention action; information for assessment of the risk of bias; identified behaviour change techniques; use of theory; mode of delivery; bowel cancer screening outcomes. Two review authors will extract data independently and discrepancies will be identified and resolved through discussion (with a third author where necessary). Missing data will be requested from study authors.

Risk of bias (quality) assessment

An adapted version of the STROBE risk of bias assessment will be used.

Strategy for data synthesis

Data will be pooled into evidence tables and a descriptive summary will be performed to determine the quantity of data, checking further for study variations in terms of the study characteristics and results. This will assist in confirming the similarity of studies and the suitability of synthesis methods.

If deemed adequate, a meta-analysis will be conducted thoroughly. For a meta-analysis of correlational data, effect size information will be collected as Pearson’s r statistic.

Analysis of subgroups or subsets

-Post-hoc sensitivity analyses will be conducted to examine the impact of removing studies

- That did not follow an intention-to-treat analysis
- That were assessed as being of high risk of bias

Contact details for further information

Soumya Shetty pssvs@leeds.ac.uk

Organisational affiliation of the review

University of Leeds

Review team members and their organisational affiliations

Miss Soumya Shetty. University of Leeds Professor Mark Conner. University of Leeds Dr Chris Keyworth. University of Leeds

Type and method of review

Systematic review

Anticipated or actual start date

01 July 2024

Anticipated completion date

01 July 2025

Funding sources/sponsors

This is part of my PhD project and there are not any funding bodies

Conflicts of interest

Language

English

Country

England

Stage of review

Review Ongoing

Subject index terms status

Subject indexing assigned by CRD

Subject index terms

MeSH headings have not been applied to this record

Date of registration in PROSPERO

25 June 2024

Date of first submission

24 June 2024

Stage of review at time of this submission

The review has not started

Stage	Started	Completed
Preliminary searches	No	No
Piloting of the study selection process	No	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

The record owner confirms that the information they have supplied for this submission is accurate and complete and they understand that deliberate provision of inaccurate information or omission of data may be construed as scientific misconduct.

The record owner confirms that they will update the status of the review when it is completed and will add publication details in due course.

Appendix 4.2. Data Extraction Form

Review title or ID	
Study ID *(surname of first author and year first full report of study was published e.g. Smith 2001)*	
Report ID	

Report ID of other reports of this study	
Notes	

General Information

Date form completed *(dd/mm/yyyy)*	
Name/ID of person extracting data	
Reference citation	
Study author contact details	
Publication type *(e.g. full report, abstract, letter)*	
Notes:	

Study eligibility

Study Characteristics	Eligibility criteria *(Insert inclusion criteria for each characteristic as defined in the Protocol)*	Eligibility criteria met?			Location in text or source *(pg & ¶/fig/table/other)*
		Yes	No	Unclear	
Type of study	Randomised Controlled Trial	☐	☐	☐	
	Quasi-randomised Controlled Trial	☐	☐	☐	
	Controlled Before and After Study Contemporaneous data collection	☐	☐	☐	

	Comparable control sites At least 2 x intervention and 2 x control clusters		
	Interrupted Time Series At least 3 time points before and 3 after the intervention Clearly defined intervention point	☐ ☐ ☐	
	Other design (specify):	☐ ☐ ☐	
Participants		☐ ☐ ☐	
Types of intervention		☐ ☐ ☐	
Types of comparison		☐ ☐ ☐	
Types of outcome measures		☐ ☐ ☐	
INCLUDE ☐		EXCLUDE ☐	
Reason for exclusion			
Notes:			

Characteristics of included studies

Methods

	Descriptions as stated in report/paper		Location in text or source *(pg & ¶/fig/table/other)*
Aim of study *(e.g. efficacy, equivalence, pragmatic)*			
Design*(e.g. parallel, crossover, non-RCT)*			
Unit of allocation *(by individuals, cluster/ groups or body parts)*			
Start date			
End date			
Duration of participation *(from recruitment to last follow-up)*			
Ethical approval needed/ obtained for study	☐ ☐ ☐ Yes No Unclear		

Notes:

Participants

	Description *Include comparative information for each intervention or comparison group if available*	Location in text or source *(pg & ¶/fig/table/other)*
Population description *(from which study participants are drawn)*		
Setting *(including location and social context)*		
Inclusion criteria		
Exclusion criteria		
Method of recruitment of participants *(e.g. phone, mail, clinic patients)*		
Informed consent obtained	☐ Yes ☐ No ☐ Unclear	
Total no. randomised *(or total pop. at start of study for NRCTs)*		

Clusters *(if applicable, no., type, no. people per cluster)*		
Baseline imbalances		
Withdrawals and exclusions *(if not provided below by outcome)*		
Age		
Sex		
Race/Ethnicity		
Severity of illness		
Co-morbidities		
Other relevant sociodemographics		
Subgroups measure		
Subgroups reported		
Notes:		

Intervention groups

Copy and paste table for each intervention and comparison group

Intervention Group 1

	Description as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Group name		
No. randomised to group *(specify whether no. people or clusters)*		
Theoretical basis *(include key references)*		
Description *(include sufficient detail for replication, e.g. content, dose, components)*		
Duration of treatment period		
Timing *(e.g. frequency, duration of each episode)*		
Delivery *(e.g. mechanism, medium, intensity, fidelity)*		

Providers *(e.g. no., profession, training, ethnicity etc. if relevant)*		
Co-interventions		
Economic information *(i.e. intervention cost, changes in other costs as result of intervention)*		
Resource requirements *(e.g. staff numbers, cold chain, equipment)*		
Integrity of delivery		
Compliance		
Notes:		

Outcomes

Copy and paste table for each outcome.

Outcome 1

	Description as stated in report/paper		Location in text or source *(pg & ¶/fig/table/other)*
Outcome name			
Time points measured *(specify whether from start or end of intervention)*			
Time points reported			
Outcome definition *(with diagnostic criteria if relevant)*			
Person measuring/ reporting			
Unit of measurement *(if relevant)*			
Scales: upper and lower limits *(indicate whether high or low score is good)*			
Is outcome/tool validated?	☐ Yes ☐ No ☐ Unclear		

Imputation of missing data *(e.g. assumptions made for ITT analysis)*		
Assumed risk estimate *(e.g. baseline or population risk noted in Background)*		
Power *(e.g. power & sample size calculation, level of power achieved)*		
Notes:		

Other

Study funding sources *(including role of funders)*		
Possible conflicts of interest *(for study authors)*		
Notes:		

Risk of Bias assessment

See Chapter 8 of the Cochrane Handbook. Additional domains may be added for non-randomised studies.

Domain	Risk of bias Low High Unclear	Support for judgement *(include direct quotes where available with explanatory comments)*	Location in text or source *(pg & ¶/fig/table/other)*
Random sequence generation *(selection bias)*	☐ ☐ ☐		
Allocation concealment *(selection bias)*	☐ ☐ ☐		
Blinding of participants and personnel *(performance bias)*	☐ ☐ ☐	Outcome group: All/	
(if separate judgement by outcome(s) required)	☐ ☐ ☐	Outcome group:	
Blinding of outcome assessment *(detection bias)*	☐ ☐ ☐	Outcome group: All/	

(if separate judgement by outcome(s) required)	☐ ☐ ☐	Outcome group:	
Incomplete outcome data *(attrition bias)*	☐ ☐ ☐	Outcome group: All/	
(if separate judgement by outcome(s) required)	☐ ☐ ☐	Outcome group:	
Selective outcome reporting? *(reporting bias)*	☐ ☐ ☐		
Other bias	☐ ☐ ☐		
Notes:			

Data and analysis

Copy and paste the appropriate table for each outcome, including additional tables for each time point and subgroup as required.

For RCT/CCT

Dichotomous outcome

	Description as stated in report/paper				Location in text or source *(pg & ¶/fig/table/other)*
Comparison					
Outcome					
Subgroup					
Time point *(specify from start or end of intervention)*					
Results	Intervention		Comparison		
	No. with event	Total in group	No. with event	Total in group	
Any other results reported *(e.g. odds ratio, risk difference, CI or P value)*					
No. missing participants					
Reasons missing					
No. participants moved from other group					
Reasons moved					

Unit of analysis *(by individuals, cluster/groups or body parts)*			
Statistical methods used and appropriateness of these *(e.g. adjustment for correlation)*			
Reanalysis required? *(specify, e.g. correlation adjustment)*	☐ ☐ ☐ Yes No Unclear		
Reanalysis possible?	☐ ☐ ☐ Yes No Unclear		
Reanalysed results			
Notes:			

For RCT/CCT

Continuous outcome

	Description as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Comparison		

<table>
<tr><td colspan="2">Outcome</td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Subgroup</td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Time point (specify from start or end of intervention)</td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Post-intervention or change from baseline?</td><td colspan="5"></td><td></td></tr>
<tr><td rowspan="3">Results</td><td colspan="3">Intervention</td><td colspan="3">Comparison</td><td rowspan="3"></td></tr>
<tr><td>Mean</td><td>SD (or other variance, specify)</td><td>No. participant</td><td>Mean</td><td>SD (or other variance, specify)</td><td>No. participants</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Any other results reported (e.g. mean difference, CI, P value)</td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">No. missing participants</td><td colspan="2"></td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">Reasons missing</td><td colspan="2"></td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">No. participants moved from other group</td><td colspan="2"></td><td colspan="3"></td><td></td></tr>
</table>

Reasons moved			
Unit of analysis *(individuals, cluster/ groups or body parts)*			
Statistical methods used and appropriateness of these *(e.g. adjustment for correlation)*			
Reanalysis required? *(specify)*	☐ ☐ ☐ Yes No Unclear		
Reanalysis possible?	☐ ☐ ☐ Yes No Unclear		
Reanalysed results			
Notes:			

For RCT/CCT

Other outcome

	Description as stated in report/paper				Location in text or source *(pg & ¶/fig/table/other)*
Comparison					
Outcome					
Subgroup					
Time point *(specify from start or end of intervention)*					
No. participant	Intervention		Control		
Results	Intervention result	SE (or other variance)	Control result	SE (or other variance)	
	Overall results		SE (or other variance)		
Any other results reported					
No. missing participants					
Reasons missing					

No. participants moved from other group			
Reasons moved			
Unit of analysis *(by individuals, cluster/groups or body parts)*			
Statistical methods used and appropriateness of these			
Reanalysis required? *(specify)*	☐ ☐ ☐ Yes No Unclear		
Reanalysis possible?	☐ ☐ ☐ Yes No Unclear		
Reanalysed results			
Notes:			

For Controlled Before-and-After study (CBA)

	Description as stated in report/paper				Location in text or source *(pg & ¶/fig/table/other)*
Comparison					
Outcome					
Subgroup					
Time point *(specify from start or end of intervention)*					
Post-intervention or change from baseline?					
No. participants	Intervention		Control		
Results	Intervention result	SE *(or other variance, specify)*	Control result	SE *(or other variance, specify)*	
	Overall results		SE *(or other variance, specify)*		
Any other results reported					

No. missing participants			
Reasons missing			
No. participants moved from other group			
Reasons moved			
Unit of analysis *(individuals, cluster/ groups or body parts)*			
Statistical methods used and appropriateness of these			
Reanalysis required? *(specify)*	☐ ☐ ☐ Yes No Unclear		
Reanalysis possible?	☐ ☐ ☐ Yes No Unclear		
Reanalysed results			
Notes:			

For Interrupted Time Series study (ITS)

	Description as stated in report/paper		Location in text or source *(pg & ¶/fig/table/other)*
Comparison			
Outcome			
Subgroup			
Length of time points measured *(e.g. days, months)*			
Total period measured			
No. participants measured			
No. missing participants			
Reasons missing			
	Pre-intervention	Post-intervention	
No. time points measured			
Mean value *(with variance measure)*			

Any other results reported					
Unit of analysis *(individuals or cluster/ groups)*					
Statistical methods used and appropriateness of these					
Reanalysis required? *(specify)*	☐ Yes ☐ No ☐ Unclear				
Reanalysis possible?	☐ Yes ☐ No ☐ Unclear				
Individual time point results					
Read from figure?	☐ Yes ☐ No				
Reanalysed results	Change in level	SE	Change in slope	SE	
Notes:					

Other information

	Description as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Key conclusions of study authors		
References to other relevant studies		
Correspondence required for further study information *(from whom, what and when)*		
Notes:		

Appendix 4.3 Search Terms

Section 1- Cancer Terms-
1. colorectal cancer.mp. 2. bowel cancer.mp. 3. colon cancer.mp. 4. rect* cancer.mp. 5. colorectal adj2 neoplasm$.mp. 6. or/1-5

Section 2- Predictor Terms-

7. Predictors of Intention
8. Predictors of behaviour
9. Predictor variables
10. Screening predictors
11. Predictors of screening
12. Predictors of participation
13. Attitude
14. Norms
15. Intention
16. Fear
17. Worry
18. Cost
19. Self-efficacy
20. Perceived risk
21. Awareness
22. Perceived barriers
23. Perceived benefits
24. or/7-23

Section 3- Screening Terms-

25. Bowel cancer screening
26. Colorectal cancer screening
27. Screening behaviour
28. Screening intention
29. Cancer screening intention
30. Cancer screening behaviour
31. Screening participation
32. cancer screen*.mp.
33. cancer prevention.mp.

34. endoscopy
35. faecal occult blood.mp.
36. occult blood test.mp.
37. self-examination.mp.
38. barium enema
39. Early diagnosis
40. Cancer prevention
41. Patient Compliance
42. Treatment compliance
43. or/25-42

Appendix 4.4 Risk of Bias (The AXIS Tool)

Overall Summary

Risk Category	*Number of Studies*	*Percentage of Studies*
Low Risk	56	67%
Moderate Risk	16	19%
High Risk	12	14%
Total	**84**	**100%**

AXIS Risk of Bias Summary Across Included Studies

AXIS Item	Yes (n, %)	No (n, %)	Unclear (n, %)
Q1: Aims/objectives clear	82 (97.6%)	2 (2.4%)	0 (0.0%)

Q2: Statistical significance assessed	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q3: CIs/p-values provided	84 (100.0%)	0 (0.0%)	0 (0.0%)
Q4: Methods sufficiently described	84 (100.0%)	0 (0.0%)	0 (0.0%)
Q5: Results internally consistent	82 (97.6%)	2 (2.4%)	0 (0.0%)
Q6: Missing data handled	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q7: Response rates reported	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q8: Non-response bias minimal	84 (100.0%)	0 (0.0%)	0 (0.0%)
Q9: Statistical methods appropriate	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q10: Limitations discussed	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q11: Ethics addressed	84 (100.0%)	0 (0.0%)	0 (0.0%)
Q12: Design appropriate	74 (88.1%)	10 (11.9%)	0 (0.0%)

Q13: Funding source reported	84 (100.0%)	0 (0.0%)	0 (0.0%)
Q14: Sample size justified	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q15: Target population defined	84 (100.0%)	0 (0.0%)	0 (0.0%)
Q16: Sample frame appropriate	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q17: Selection representative	83 (98.8%)	1 (1.2%)	0 (0.0%)
Q18: Non-responders addressed	77 (91.7%)	7 (8.3%)	0 (0.0%)
Q19: Variables measured appropriately	84 (100.0%)	0 (0.0%)	0 (0.0%)
Q20: Measures valid/reliable	82 (97.6%)	2 (2.4%)	0 (0.0%)

Note. AXIS = Appraisal Tool for Cross-Sectional Studies (Downes et al., 2016). Percentages are calculated out of 84 included studies. “Unclear” corresponds to the AXIS category “Don’t know/cannot determine.” “N/A” indicates the item was not applicable for a given study.

Appendix 4.4 Study Characteristics of Included Studies

Study ID	Year	Location	Outcome Type	Predictor
Almadi MA et al.	2019	Saudi Arabia (national survey)	Intention	Knowledge
Bai Y et al.	2020	China	Behaviour	Perceived severity, Percieved Barriers , Percieved Benefits, Percieved Susceptibility
CN Klabunde et al	2006	US	Behaviour	Self efficacy
Becker et al., 2018	2018.	United States	Intention	Perceived severity
Bhopal R et al	2020	UK	Behaviour	Ethnicity
Bianchi M et al.	2024	Italy	Behaviour	Intention
Bingzi Shi	2025	China	Behaviour	Perceived severity, Percieved Benefits, Percieved Susceptibility , Self efficacy

Boutsicaris AS et al.	2021.	Ohio & Appalachian regions, USA	Intention	Knowledge
Brandt HM et al.	2012.	South Carolina, USA	Behaviour	Knowledge
Bujang NNA et al.	2021.	Malaysia	Behaviour	Knowledge
Campbell C et al.	2019	UK	Behaviour	Ethnicity
C Vrinten et al	2015	UK	Behaviour	Perceived severity
Castañeda-Avila MA et al.	2024	US	Intention	Ethnicity
A Christou	2012	Western Australia, Australia	Behaviour, Intention	Knowledge, Self efficacy
AG Bateman	2023	US	Intention	Percieved Barriers , Percieved Benefits, Self efficacy
C Senore et al	2015.	Italy	Intention	Knowledge
Courtney RJ et al.	2012.	Australia	Behaviour	Knowledge
DYP Leung et al	2018.	Asia	Intention	Perceived severity
Dreier M et al.	2024	Germany	Behaviour	Intention

Duncan A et al.	2014.	South Australia	Behaviour	Age
LM Reynolds	2018.	United Kingdom	Behaviour	Age
Eunice Lee	2019	US	Behaviour, Behaviour	Perceived severity, Percieved Barriers , Percieved Benefits
SK Smith et al	2014	Australia	Intention	Self efficacy
J Huang et al	2021	Hong Kong, China	Behaviour, Intention	Perceived severity, Percieved Benefits
Ferrat E et al.	2013.	France	Behaviour	Age
Flight, Wilson & McGillivray (2012	2012.	Australia	Behaviour	Intention
Glenn BA et al.	2018.	United States (CRC hotspots cohorts)	Behaviour	Percieved Barriers , Percieved Susceptibility
Greaney ML et al.	2014	US	Intention	Ethnicity
Gregory et al., 2011	2011.	Australia	Intention	Knowledge, Percieved Barriers , Percieved Susceptibility

Greiner KA et al.	2014.	Kansas City, USA (urban safety-net clinics)	Behaviour, Intention	Age, Intention , Self efficacy
Hoffman R.M. et al., 2011	2011.	Canada	Behaviour	Percieved Benefits, Percieved Susceptibility
Huang J et al.	2020	China	Behaviour	Intention
Janda et al., 2003	2003.	Queensland, Australia (rural community)	Intention	Age, Percieved Susceptibility
Katz ML et al.	2013.	Ohio Appalachia, USA	Intention	Knowledge
Klasko-Foster B et al.	2018.	United States (African American cohort)	Behaviour, Behaviour , Intention	Knowledge, Percieved Barriers , Percieved Benefits, Percieved Susceptibility , Self efficacy
Knight JR et al.	2015	US	Behaviour	Perceived severity, Percieved Barriers , Percieved Benefits,

				Percieved Susceptibility
JH Koo ET AL	2013.	Hong Kong, China	Intention, Intention	Knowledge, Percieved Barriers , Percieved Susceptibility
Krieger JL et al.	2021	US	Intention	Ethnicity
Kroupa R et al.	2019	Chez Republic	Behaviour	Perceived severity, Percieved Barriers , Percieved Benefits, Percieved Susceptibility
Lee K et al.	2021.	South Korea (intention for colonoscopy)	Behaviour	Perceived severity, Percieved Susceptibility
Lich KH et al.	2023.	United States	Behaviour	Age
MD Knudsen	2022	Italy	Intention	Percieved Barriers
Lin (I-Pei) et al., 2020	2020.	Taiwan	Intention	Perceived severity Age
Maheri et al. (2022	2022.	Iran	Intention, Itntention	Percieved Susceptibility , Self efficacy
Martínez-Ochoa E et al.	2012.	Spain	Behaviour	Knowledge

Mirzaei-Alavijeh et al., 2019 (	2019.	Iran	Intention	Perceived severity, Percieved Susceptibility , Self efficacy
Myers RE et al.	2008.	United States	Intention	Percieved Susceptibility
M Janda et al	2003	Australia	Intention	Norms,Knowledge
Nguyen (T.T.) et al., 2016	2016.	United States (Asian Americans, California)	Behaviour	Percieved Barriers
O’Carroll RE et al.	2011	UK	Behaviour	Intention , Percieved Benefits
Pluymen L.P.M. et al., 2023	2023.	Netherlands	Behaviour	Perceived severity, Percieved Barriers , Percieved Benefits, Percieved Susceptibility
Poncet F et al.	2013.	Isère, France	Behaviour	Age
Power et al., 2008	2008.	UK	Behaviour	Intention
FA Macrae et al	1984	Australia	Behaviour , Intention, Intention	Perceived severity, Percieved Barriers , Percieved

				Susceptibility , Self efficacy
F Besharati	2018	Iran	Intention	Benefits, Self-efficacy
J Gu	2023	China	Intention, Intention	Perceived severity, Percieved Barriers , Percieved Benefits, Percieved Susceptibility , Self efficacy
AA Ramazani et al	2021	Iran	Behaviour	Self efficacy
F Besharati et al	2018	Iran	Behaviour, Intention, Intention	Percieved Barriers , Percieved Benefits, Self efficacy
M Maheri et al	2022	Iran	Intention	Self efficacy
J Atarere	2024	United States (HINTS 2018–2020)	Behaviour	Age
J Wardle	2000	United Kingdom	Intention, Intention	Perceived severity, Percieved Barriers , Percieved Benefits,

				Percieved Susceptibility
Quick B.W. et al., 2013	2013.	United States (Ohio Appalachia)	Behaviour	Percieved Barriers
Robb KA et al.	2008.	United Kingdom	Behaviour, Intention	Ethnicity , Intention
Rogers CR et al.	2016.	United States	Intention	Age, Knowledge
Roh S et al.	2021.	South Korea	Behaviour	Knowledge, Self efficacy
Salz T et al.	2013.	United States	Behaviour	Percieved Susceptibility
Scaglioni et al 2022	2022.	Italy	Intention, Itention	Perceived severity, Self efficacy
Shokar NK et al.	2022	US	Behaviour	Self efficacy
Singh R et al.	2010	Canada	Behaviour	Ethnicity
Sy AU et al.	2018	US	Behaviour	Ethnicity
SYH Chiu	2017	China	Behaviour	Perceived Susceptibility
Tam TKW et al.	2011.	Hong Kong SAR (primary care clinics)	Behaviour	Knowledge
Taouqi M et al.	2022.	Morocco (high-risk	Behaviour	Knowledge

		populations) – likely		
Vanaclocha-Espí C et al.	2017.	Spain (multi-regional CRC screening programmes)	Behaviour	Age
Wei et al	2022	China	Intention	Percieved Barriers
Wong MCS et al.	2014	Asia	Behaviour	Perceived severity, Percieved Benefits, Percieved Susceptibility
Yebyo H.G. et al., 2024	2024.	Europe	Behaviour	Age
Zamorano-León JJ et al.	2020.	Spain (Spanish National Health Surveys 2011 & 2017)	Behaviour	Age
Zamorano-León JJ et al.	2020.	Spain (Spanish National Health Surveys 2011 & 2017)	Behaviour	Age
Zheng YF et al.	2014.	United Kingdom (Chinese community in	Behaviour	Perceived severity, Percieved Susceptibility

		England) – likely		
Zimmerman RK et al.	2006.	United States (diverse primary care practices)	Behaviour	Age
W Wei	2022	China	Behaviour	Intention , Self efficacy
JJY Song	2008	China	Behaviour	HBM
von Wagner C et al.	2011.	United Kingdom	Behaviour	Perceived Barriers , Perceived Benefits

Note. Study ID corresponds to the first author (APA style). Outcome type refers to Behaviour (actual uptake) or Intention (self-reported). Predictors are listed as reported.

Chapter 5

Appendix C. 5.1 PMT Survey

Introduction: Bowel cancer screening can lead to early detection of bowel cancer and better health outcomes. Both the NHS (in the United Kingdom) and the Indian Cancer Society (in India) offer free bowel cancer screening programmes. We would like to ask you about your views on participating in bowel cancer screening. There are no right or wrong answers. Please read each question carefully before responding.

Instructions:

Bowel screening can involve completing a home test kit (otherwise known as a FIT test, which is common in UK) or attending for a colonoscopy (common in India). Please answer the questions based on the type of screening that applies to your country of residence. Within the questions, the phrase "doing a bowel screening test in the future" refers to completing the screening test available in your country (e.g., a home test/FIT test or a colonoscopy).

If you have any questions about the survey or the research project, you may contact the primary investigator, Soumya Shetty (Researcher at The University of Leeds), via email at: pssvs@leeds.ac.uk

Thank you for your participation

Section 1:

1. What is the highest degree or level of school you have completed?
    - ☐ Graduate
    - ☐ Postgraduate
    - ☐ High school Diploma
    - ☐ Trade/technical/vocational training
    - ☐ No schooling completed

Section 2:

Knowledge:

Scale-True or False

1. Doing a bowel cancer screening test in the future can help find bowel cancer early, even if you have no symptoms.
2. Doing a bowel cancer screening test in the future is only important if you have symptoms.
3. Doing a bowel cancer screening test in the future helps with early detection and reduces mortality by improving treatment outcomes.

<u>Section 3:</u>

<u>Past Behaviour:</u>

Scale- Yes or No

1. I have completed a bowel cancer screening test before.

<u>Section 4:</u>

<u>Perceived Severity:</u>

Scale-1 - 6

1. I am certain that if I were to develop bowel cancer it would limit my community activities. (extremely uncertain-extremely certain)
2. How likely do you think it is that you would have to stop living your life the way that you want to, if you develop bowel cancer? (extremely likely- extremely unlikely) [R]
3. If I develop bowel cancer it is likely that my finances would be at risk. (extremely unlikely – extremely likely)
4. I am certain that if I were to develop bowel cancer it would damage important relationships in my life. (extremely uncertain – extremely certain)
5. If I develop bowel cancer, it could almost certainly cause my death. (disagree very strongly – agree very strongly)
6. How likely is it that you will die if you develop bowel cancer? (extremely unlikely – extremely likely)
7. If I develop bowel cancer I am certain that I would experience a lot of physical pain (extremely certain – extremely uncertain) [R]
8. If I develop bowel cancer, I am certain that I would experience a lot of physical sickness. (extremely uncertain – extremely certain)

Perceived Vulnerability:

Scale-1-6

1. In comparison with other people my age my chances of developing bowel cancer are. (extremely low – extremely high)
2. I think that my chances of developing bowel cancer are. (extremely high – extremely low) [R]
3. I feel personally at risk of developing bowel cancer. (agree very strongly – disagree very strongly) [R]
4. I think that my chances of developing bowel cancer are very low (agree very strongly – disagree very strongly)
5. How likely do you think it is that you will develop bowel cancer? (extremely likely – extremely unlikely) [R]
6. I am at less risk of developing bowel cancer than other people my age. (agree very strongly – disagree very strongly)

Response efficacy:

Scale-1 = Extremely unlikely to happen, 6 = Extremely likely to happen

1. Doing a bowel cancer screening test in the future would reduce my chances of dying from bowel cancer
2. Doing a bowel cancer screening test in the future would help find any abnormalities
3. Doing a bowel cancer screening test in the future would increase my chances of getting treatment earlier
4. Doing a bowel cancer screening test in the future would help me avoid having to have drastic treatment
5. Doing a bowel cancer screening test in the future would put my mind at rest about bowel cancer
6. Doing a bowel cancer screening test in the future would reduce any worries I might have about getting bowel cancer
7. Doing a bowel cancer screening test in the future would increase my confidence about not getting bowel cancer
8. Doing a bowel cancer screening test in the future would reduce any worries I might have about having other abnormalities

Self-efficacy:

Scale-1-6

1. If I am invited to do a bowel cancer screening test in the future, I am certain that I could do it. (extremely uncertain – extremely certain)
2. If I am invited to do a bowel cancer screening test in the future, I would feel very confident in my ability to do it. (disagree very strongly – agree very strongly)
3. If I am invited to do a bowel cancer screening test in the future, I believe that I would be able to do it. (agree very strongly – disagree very strongly) [R]

Response Costs:

Scale-1 = Extremely unlikely to happen-6 = Extremely likely to happen

1. Doing a bowel cancer screening test in the future would be an invasion of my privacy
2. Doing a bowel cancer screening test in the future would be embarrassing
3. Doing a bowel cancer screening test in the future would lead to unpleasant treatment when abnormalities are found
4. Doing a bowel cancer screening test in the future would be disgusting
5. Doing a bowel cancer screening test in the future would be unhygienic

Section 5:

Scale-1-6 (1 = Extremely unlikely to happen - 6 = Extremely likely to happen)

Intentions/Protection motivation:

1. I intend to do a bowel cancer screening test in the future.
2. I want to do a bowel cancer screening test in the future.
3. I expect to do a bowel cancer screening test in the future.

Appendix 5.2 Participant Information Sheet

Participant Information Sheet

Project Title-Understanding and identifying predictors of Bowel Cancer screening intention across different populations

You are being invited to take part in this research project. Before you decide to participate, it is important for you to understand why this research is being conducted and what it involves.

Please take some time to read the following information carefully. If you have any questions regarding this study or if there is anything that is not clear or if you would like more information about any section mentioned here, please contact Soumya Shetty via email- pssvs@leeds.ac.uk. Please take the time to decide whether or not you wish to take part in this research study. Thank you for your time and consideration.

Purpose of the study-

The purpose of this study is to gain a better understanding about what factors predict people's intention to participate in bowel cancer screening programmes. Additionally, through this study we aspire to examine the relationship between predictors of bowel cancer screening and screening intention across different populations.

Why have I been chosen?

Our study aims to recruit participants from diverse backgrounds to better understand how bowel cancer screening intention varies across different populations. You were chosen as a participant since you meet the inclusion criteria of this study i.e., you are eligible for bowel cancer screening according to the eligibility criteria set by the governing medical body of your country and you are not currently seeking treatment for bowel cancer.

What will I have to do?

If you decide to participate in this study, you will be required to complete an online survey that takes about five minutes to finish, this survey would be conducted online via Prolific or Besample. Your responses will be collected and recorded by the online platform for data analysis purposes.

Possible risks of taking part in this study-

Although there are no direct risks involved in participating in this study, it is important to note that the questions asked during the survey would revolve around personal healthcare choices and bowel cancer which could be triggering to some participants, we would therefore like to request you to consider this before agreeing to participate in this study. If you have any questions or concerns regarding this, you can always contact the researcher via email.

Benefits of participating in this study-

For your invaluable contribution and active participation in the survey you would be given a reward sent directly to you via the online survey platform.

Use, dissemination, and storage of research data-

The data collected from this study would be stored by the researchers and would be used in relevant future research in an anonymised form. Additionally, all data collected during this study may be looked at by individuals from the University of Leeds or from regulatory authorities if required. It should also be noted that anonymised data might be used in publications, academic conferences, dissertation, and paper presentations.

Participant personal information-

All participant responses would be kept confidential. All survey responses will be anonymised and only then presented in the study. All participants will be assigned a participation code to maintain anonymity. All the contact information collected during the research will be kept strictly confidential and will be stored separately from the research data. Steps would be taken to anonymise the research data such that the participant would not be identified in any reports or publications.

Results of the research project-

The results from this study could be used for subsequent research and could also be published in academic journals or presented in academic conferences and paper presentations.

What type of information would be collected?

The participants would be filling in an online survey; this survey would be focused on understanding what factors predict bowel cancer screening intention among people. Through this study we aim to examine the relationship between predictors of bowel cancer screening and screening intention across different populations. We also aspire to identify ways to make bowel cancer screening programs more inclusive and effective.

Will I be recorded, and how will the recorded media be used?

All survey responses will be saved and recorded by the online survey platform. All responses will be kept confidential. People outside this project would not have access to these responses. The participants filling out the survey would not be recorded, only their reposes would be stored and recorded. It should also be noted that anonymised data from these surveys may be used in journal publications.

Who is organising this research?

This research is a part of a PhD project by Soumya Shetty from University of Leeds under the supervision of Dr. Mark Conner and Dr. Chris Keyworth.

Contact for further information-

For any questions regarding this research project and your participation please contact researcher Soumya Shetty via email- pssvs@leeds.ac.uk

University of Leeds Privacy note- https://dataprotection.leeds.ac.uk/research-participant-privacy-notice/

If you want to know more about the bowel cancer screening programs available in your country, you can check out the links below: -

For UK-
https://www.cancerresearchuk.org/?gclid=EAIaIQobChMIhMLGjdzb_gIV1e3tCh0FKgwBEAAYASAAEgKGNPD_BwE&gclsrc=aw.ds

For India-

https://www.indiancancersociety.org/

Chapter 6

Appendix D. 6.1 PROSPERO Protocol

Review objectives

What does bowel cancer screening behaviour look like across different populations?
Does the effectiveness of various interventions vary across different groups (ethnicity, gender, SES)?

Keywords

Behaviour, Bowel cancer screening, Intention, Interventions, Predictors

SEARCHING AND SCREENING

Searches

We searched the following databases- MEDLINE (1950-), EMBASE (1947-) PsycINFO (1806-) Web of Science (1999-) and The Cochrane Library. Searches were restricted to articles in the English language.

Study design

Studies were included if they incorporated screening behaviour by using Faecal Occult Blood Test (FOBT), Faecal Immunochemical Test (FIT), Flexible Sigmoidoscopy (FS), colonoscopy or barium enema. Studies were excluded if they were an abstract, a dissertation, a protocol, a poster, a think-piece or guidelines. Studies were excluded if they were not reported in English. Studies that did not report statistics in the results or were subset or secondary analyses to previous papers, were excluded.

ELIGIBILITY CRITERIA

Condition or domain being studied

Bowel cancer screening behaviour, intention and interventions.

Population

Studies were included if they recruited participants that were at least 40 years of age.

Intervention(s) or exposure(s)

Studies were included that tested the effect of an intervention on increasing colorectal cancer screening adherence, for instance studies that explore the effects of interventions rooted in cultural sensitivity on improving bowel cancer screening participation in local communities.

Comparator(s) or control(s)

The main interventions (for example- Interventions targeting behaviour change like providing social support) were compared against alternative interventions, usual care, no-intervention control groups and/or delayed treatment conditions.

OUTCOMES TO BE ANALYSED

Main outcomes

To understand bowel cancer screening behaviour among different groups. To assess whether certain interventions are more effective than others in increasing participation in bowel cancer screening programs among different groups (both self-reported and based on objective measures).

Measures of effect

Screening adherence must be reported post-intervention. Where there are multiple subgroups within a study, an average effect within each subgroup will be computed to produce a composite score. Where there are multiple time-points within a study, a single effect size will be computed.

Additional outcomes

To identify predictors of bowel cancer screening behaviour. Studies will be assessed to see if factors like socioeconomic status, ethnicity, intention, gender, self-efficacy, perceived benefits and emotions predict bowel cancer screening behaviour. Here self-reported data will be analysed.

DATA COLLECTION PROCESS

Data extraction (selection and coding)

Titles and abstracts will be independently screened by two members of the review team to identify the papers possibly suitable for inclusion. The same two reviewers will then complete full text screenings of all the papers identified at the previous stage. A standardised, pre-piloted form will be used to extract data from the included studies for assessment of study quality and evidence synthesis. Extracted information will include details of the intervention and control conditions; study population and participant demographics and baseline characteristics; study setting; study methodology; suggested mechanisms of intervention action; information for assessment of the risk of bias; identified behaviour change techniques; use of theory; mode of delivery; bowel cancer screening outcomes. Two review authors will extract data independently and discrepancies will be identified and resolved through discussion (with a third author where necessary). Missing data will be requested from study authors.

Risk of bias (quality) assessment

Bias risk will be assessed using the Cochrane Collaboration's tool for assessing risk of bias. Based on the Cochrane guidelines, risk of bias in included studies is assessed by considering the following characteristics:

1) Random sequence generation (selection bias)
2) Allocation concealment (selection bias)
3) Blinding of participants & personnel (performance bias)
4) Blinding of outcome assessment (detection bias)
5) Incomplete outcome data (attrition bias)
6) Selective reporting (reporting bias)

Risk of bias for included studies in the present review was further assessed by considering whether studies followed an intention-to-treat analysis.

PLANNED DATA SYNTHESIS

Strategy for data synthesis

Effect sizes will be calculated for each study reflecting the impact of the intervention on bowel cancer screening adherence. Where there are multiple subgroups within a study, an average effect within subgroups will be computed.

Where there are multiple time-points within a study, a single effect size will be computed. Meta-analyses will be conducted to estimate overall effect size with meta-regression to test the association between specific sociodemographic variables, intervention characteristics and intervention effect size.

Analysis of subgroups or subsets

Post-hoc sensitivity analyses will be conducted to examine the impact of removing studies
- That did not follow an intention-to-treat analysis
- That were assessed as being of high risk of bias

REVIEW AFFILIATION, FUNDING AND PEER REVIEW

Review team members

- Miss Soumya Shetty, University of Leeds
- Mr William Sheppard, University of Leeds
- Dr. Elizabeth Travis
- Professor Mark Conner, University of Leeds
- Dr Chris Keyworth, University of Leeds

Review affiliation

University of Leeds

Funding source

This is part of my PhD project and there are not any funding bodies

Named contact

Soumya Shetty. A-2015, Study Inn. Grace Street, Leeds.
pssvs@leeds.ac.uk

TIMELINE OF THE REVIEW

Review timeline 1 change

Start date: 01 February 2023. End date: 26 May 2025

Date of first submission to PROSPERO

12 February 2023

Date of registration in PROSPERO

13 February 2023

CURRENT REVIEW STAGE

Publication of review results

The intention is to publish the review once completed. The review will be published in English

Stage of the review at this submission

Review stage	Started	Completed
Pilot work		
Formal searching/study identification	✓	
Screening search results against inclusion criteria		
Data extraction or receipt of IP		
Risk of bias/quality assessment		
Data synthesis		

Review status

The review is currently planned or ongoing.

ADDITIONAL INFORMATION

PROSPERO version history

- Version 1.1 published on 04 Apr 2024
- Version 1.0 published on 13 Feb 2023

Review conflict of interest

None known

Country

England

Medical Subject Headings

Early Detection of Cancer; Ethnicity; Humans; Intestinal Neoplasms; Intestines

Revision note 1 change

I have just updated the tentative review completion date as that needed to be extended.

Disclaimer

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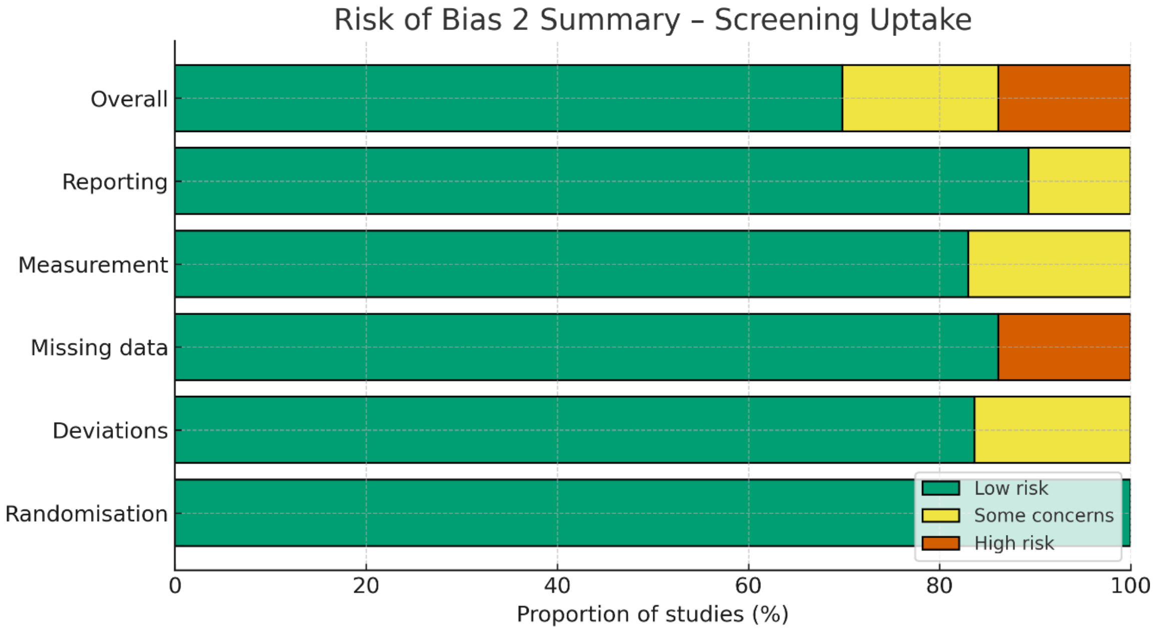
Any enquiries about the record should be referred to the named review contact

Appendix 6.2 Risk of Bias

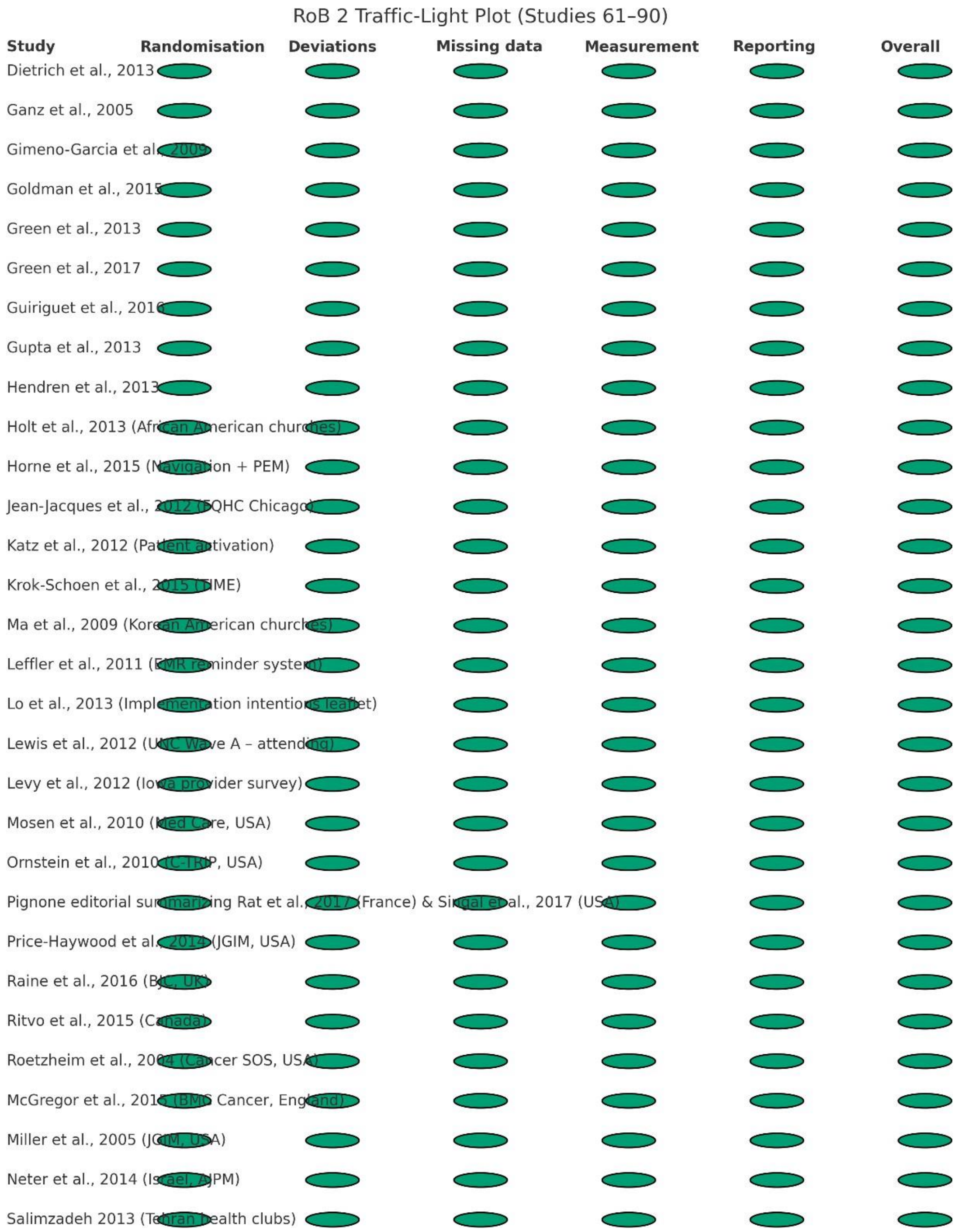


RoB 2 Traffic-Light Plot (Studies 1–30)

Study	Randomisation	Deviations	Missing data	Measurement	Reporting	Overall
McClellan et al 2023	🟢	🟢	🟠	🟢	🟢	🟠
Fernaandez 2015	🟢	🟢	🟢	🟢	🟢	🟢
Fernaandez 2015	🟢	🟢	🟢	🟢	🟢	🟢
Walsh 2020	🟢	🟢	🟢	🟢	🟢	🟢
Arnold 2019	🟢	🟢	🟢	🟢	🟢	🟢
Beach 2007	🟢	🟢	🟢	🟢	🟢	🟢
Ha et al 2014	🟢	🟢	🟢	🟢	🟢	🟢
Ha et al 2014	🟢	🟢	🟢	🟢	🟢	🟢
Ha et al 2014	🟢	🟢	🟢	🟢	🟢	🟢
Maxwell et al. 2011	🟢	🟢	🟢	🟢	🟢	🟢
Lairson et al 2020	🟢	🟢	🟢	🟢	🟢	🟢
Campbell et al 2024	🟢	🟢	🟢	🟢	🟢	🟢
Campbell et al 2024	🟢	🟢	🟢	🟢	🟢	🟢
Campbell et al 2024	🟢	🟢	🟢	🟢	🟢	🟢
Haverkamp et al 2020	🟢	🟢	🟢	🟢	🟢	🟢
Haverkamp et al 2020	🟢	🟢	🟢	🟢	🟢	🟢
Davis et al 2020	🟢	🟢	🟢	🟢	🟢	🟢
Beach et al 2008	🟢	🟢	🟢	🟢	🟢	🟢
Enard et al 2015	🟢	🟢	🟢	🟢	🟢	🟢
Phillips 2015	🟢	🟢	🟢	🟢	🟢	🟢
Phillips 2015	🟢	🟢	🟢	🟢	🟢	🟢
Champion 2018	🟢	🟢	🟢	🟢	🟢	🟢
Champion 2018	🟢	🟢	🟢	🟢	🟢	🟢
Champion 2018	🟢	🟢	🟢	🟢	🟢	🟢
Clouston 2014	🟢	🟢	🟢	🟢	🟢	🟢
Coronado 2018	🟢	🟢	🟢	🟢	🟢	🟢
Costanza 2007	🟢	🟢	🟢	🟢	🟢	🟢
Cuaresma 2018	🟢	🟢	🟢	🟢	🟢	🟢
Davis et al 2018	🟢	🟢	🟢	🟢	🟢	🟢
DeGroff 2017	🟢	🟢	🟢	🟢	🟢	🟢

RoB 2 Traffic-Light Plot (Studies 31–60)

Study	**Randomisation**	**Deviations**	**Missing data**	**Measurement**	**Reporting**	**Overall**
Wheeler 2020	🟢	🟢	🟢	🟢	🟢	🟢
Walsh 2005	🟢	🟢	🟢	🟢	🟢	🟢
Stokamer 2004	🟢	🟢	🟢	🟢	🟢	🟢
Sepucha 2018	🟢	🟢	🟢	🟢	🟢	🟢
Percac-Lima, 2009	🟢	🟢	🟢	🟢	🟢	🟢
Huf 2020	🟢	🟢	🟢	🟢	🟢	🟢
Preston 2017	🟢	🟢	🟢	🟢	🟢	🟢
Preston 2017	🟢	🟢	🟢	🟢	🟢	🟢
Gruner 2020	🟢	🟢	🟢	🟢	🟢	🟢
Gruner 2020	🟢	🟢	🟢	🟢	🟢	🟢
Atlas 2012	🟢	🟢	🟢	🟢	🟢	🟢
Coronado 2017	🟢	🟢	🟢	🟢	🟢	🟢
Tilley 1999	🟢	🟢	🟢	🟢	🟢	🟢
Cole 2017	🟢	🟢	🟢	🟢	🟢	🟢
Cole 2017	🟢	🟢	🟢	🟢	🟢	🟢
Selva 2019	🟢	🟢	🟢	🟢	🟢	🟢
Bourmaud et al 2023	🟢	🟢	🟢	🟢	🟢	🟢
Dominic 2020	🟢	🟢	🟢	🟢	🟢	🟢
Slater 2018	🟢	🟢	🟢	🟢	🟢	🟢
Aragones et al., 2010	🟢	🟢	🟢	🟢	🟢	🟢
Baker et al., 2014	🟢	🟢	🟢	🟢	🟢	🟢
Barthe et al., 2015	🟢	🟢	🟢	🟢	🟢	🟢
Basch et al., 2006	🟢	🟢	🟢	🟢	🟢	🟢
Boguradzka et al., 2014	🟢	🟢	🟢	🟢	🟢	🟢
Braun et al., 2005	🟢	🟢	🟢	🟢	🟢	🟢
Cameron et al., 2011	🟢	🟢	🟢	🟢	🟢	🟢
Christy et al., 2013	🟢	🟢	🟢	🟢	🟢	🟢
Cohen-Cline et al., 2014	🟢	🟢	🟢	🟢	🟢	🟢
Coronado et al., 2011	🟢	🟢	🟢	🟢	🟢	🟢
Dietrich et al., 2006	🟢	🟢	🟢	🟢	🟢	🟢

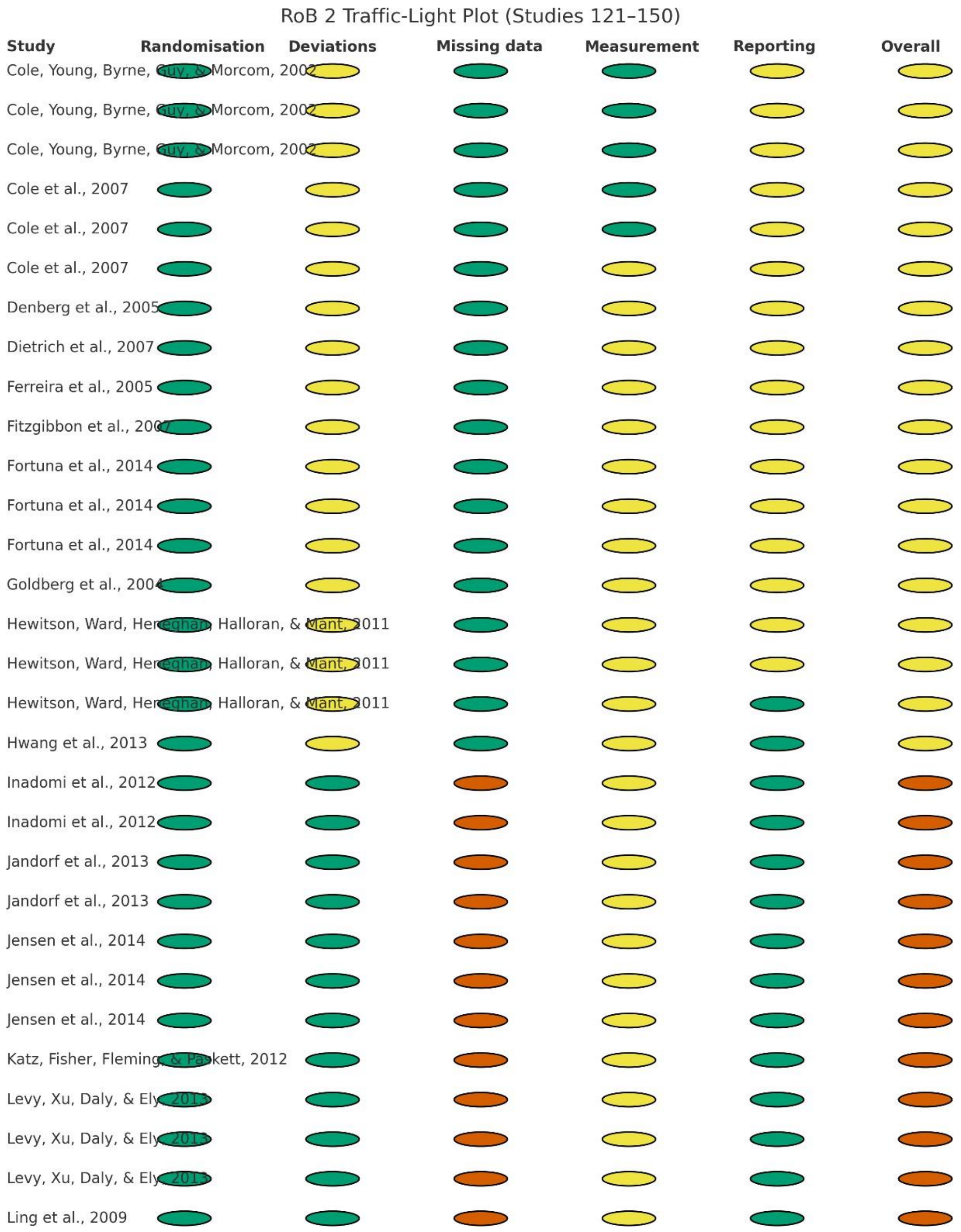


RoB 2 Traffic-Light Plot (Studies 61–90)

Study	Randomisation	Deviations	Missing data	Measurement	Reporting	Overall
Dietrich et al., 2013	🟢	🟢	🟢	🟢	🟢	🟢
Ganz et al., 2005	🟢	🟢	🟢	🟢	🟢	🟢
Gimeno-Garcia et al., 2009	🟢	🟢	🟢	🟢	🟢	🟢
Goldman et al., 2015	🟢	🟢	🟢	🟢	🟢	🟢
Green et al., 2013	🟢	🟢	🟢	🟢	🟢	🟢
Green et al., 2017	🟢	🟢	🟢	🟢	🟢	🟢
Guiriguet et al., 2016	🟢	🟢	🟢	🟢	🟢	🟢
Gupta et al., 2013	🟢	🟢	🟢	🟢	🟢	🟢
Hendren et al., 2013	🟢	🟢	🟢	🟢	🟢	🟢
Holt et al., 2013 (African American churches)	🟢	🟢	🟢	🟢	🟢	🟢
Horne et al., 2015 (Navigation + PEM)	🟢	🟢	🟢	🟢	🟢	🟢
Jean-Jacques et al., 2012 (FQHC Chicago)	🟢	🟢	🟢	🟢	🟢	🟢
Katz et al., 2012 (Patient activation)	🟢	🟢	🟢	🟢	🟢	🟢
Krok-Schoen et al., 2015 (TIME)	🟢	🟢	🟢	🟢	🟢	🟢
Ma et al., 2009 (Korean American churches)	🟢	🟢	🟢	🟢	🟢	🟢
Leffler et al., 2011 (EMR reminder system)	🟢	🟢	🟢	🟢	🟢	🟢
Lo et al., 2013 (Implementation intentions leaflet)	🟢	🟢	🟢	🟢	🟢	🟢
Lewis et al., 2012 (UNC Wave A – attending)	🟢	🟢	🟢	🟢	🟢	🟢
Levy et al., 2012 (Iowa provider survey)	🟢	🟢	🟢	🟢	🟢	🟢
Mosen et al., 2010 (Med Care, USA)	🟢	🟢	🟢	🟢	🟢	🟢
Ornstein et al., 2010 (C-TRIP, USA)	🟢	🟢	🟢	🟢	🟢	🟢
Pignone editorial summarizing Rat et al., 2017 (France) & Singal et al., 2017 (USA)	🟢	🟢	🟢	🟢	🟢	🟢
Price-Haywood et al., 2014 (JGIM, USA)	🟢	🟢	🟢	🟢	🟢	🟢
Raine et al., 2016 (BJC, UK)	🟢	🟢	🟢	🟢	🟢	🟢
Ritvo et al., 2015 (Canada)	🟢	🟢	🟢	🟢	🟢	🟢
Roetzheim et al., 2004 (Cancer SOS, USA)	🟢	🟢	🟢	🟢	🟢	🟢
McGregor et al., 2015 (BMC Cancer, England)	🟢	🟢	🟢	🟢	🟢	🟢
Miller et al., 2005 (JGIM, USA)	🟢	🟢	🟢	🟢	🟢	🟢
Neter et al., 2014 (Israel, AJPM)	🟢	🟢	🟢	🟢	🟢	🟢
Salimzadeh 2013 (Tehran health clubs)	🟢	🟢	🟢	🟢	🟢	🟢

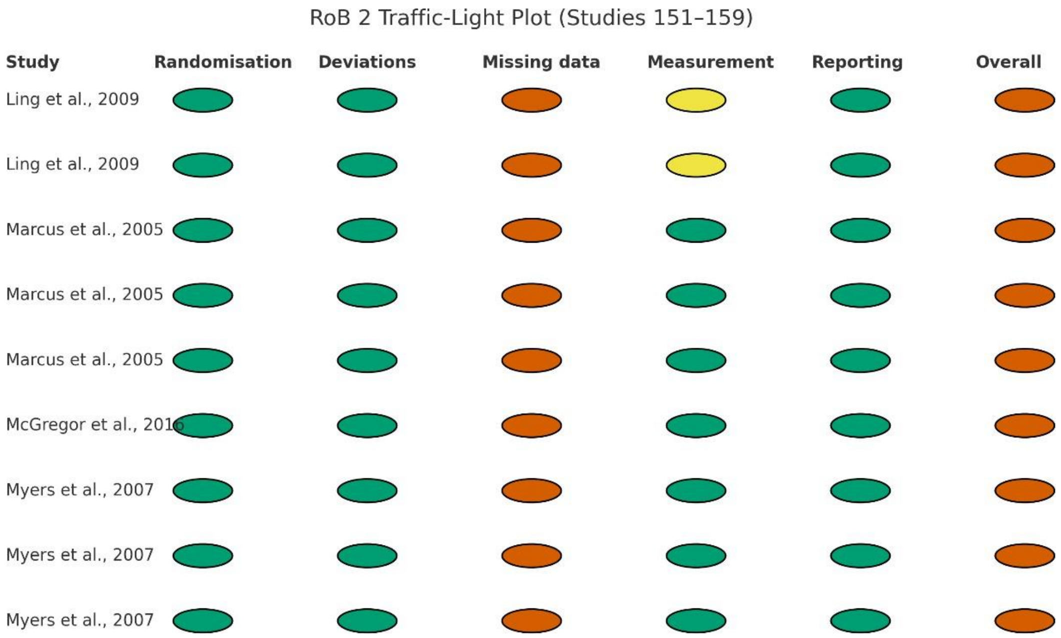
RoB 2 Traffic-Light Plot (Studies 91–120)

Study	Randomisation	Deviations	Missing data	Measurement	Reporting	Overall
Sequist 2011 (Electronic portal messages)	🟩	🟩	🟩	🟩	🟩	🟩
Shaw 2013 (SCOPE trial, NJ practices)	🟩	🟩	🟩	🟩	🟩	🟩
Simon 2010 (Automated telephone outreach)	🟩	🟩	🟩	🟩	🟩	🟩
Tu 2006 (Chinese-American clinic)	🟩	🟩	🟩	🟩	🟩	🟩
Tinmouth 2014 (Ontario mailed invitation)	🟩	🟩	🟩	🟩	🟩	🟩
van Roon 2011 (Netherlands advance letters)	🟩	🟩	🟩	🟩	🟩	🟩
Lemon 2013 (Patient education Iran)	🟩	🟩	🟩	🟩	🟩	🟩
Atlas 2025 (EHR SmartLink accuracy)	🟩	🟩	🟩	🟩	🟩	🟩
Hagoel 2016 (Israel)	🟩	🟩	🟩	🟩	🟩	🟩
Hagoel 2016 (Israel)	🟩	🟩	🟩	🟩	🟩	🟩
Hagoel 2016 (Israel)	🟩	🟩	🟩	🟩	🟩	🟩
Hagoel 2016 (Israel)	🟩	🟩	🟩	🟩	🟩	🟩
Jandorf 2013 (NYC)	🟩	🟩	🟩	🟩	🟩	🟩
Jandorf 2013 (NYC)	🟩	🟩	🟩	🟩	🟩	🟩
Vernon 2011 (Houston)	🟩	🟩	🟩	🟩	🟩	🟩
Vernon 2011 (Houston)	🟩	🟩	🟩	🟩	🟩	🟩
Hirst et al., 2017	🟩	🟩	🟩	🟩	🟩	🟩
Allgood et al., 2016	🟩	🟩	🟩	🟩	🟩	🟩
(Saini et al., 2023	🟩	🟩	🟩	🟩	🟩	🟩
Oyalowo et al., 2022	🟩	🟩	🟩	🟩	🟩	🟩
Oyalowo et al., 2022	🟩	🟩	🟩	🟩	🟩	🟩
Temucin & Nahcivan, 2018	🟩	🟩	🟩	🟩	🟩	🟩
Blumenthal, Smith, Majett, & Alema-Mensah, 2010	🟩	🟨	🟩	🟩	🟩	🟨
Blumenthal, Smith, Majett, & Alema-Mensah, 2010	🟩	🟨	🟩	🟩	🟩	🟨
Blumenthal, Smith, Majett, & Alema-Mensah, 2010	🟩	🟨	🟩	🟩	🟩	🟨
Braun et al., 2015	🟩	🟨	🟩	🟩	🟩	🟨
Christie et al., 2008	🟩	🟨	🟩	🟩	🟩	🟨
Church et al., 2004	🟩	🟨	🟩	🟩	🟩	🟨
Church et al., 2004	🟩	🟨	🟩	🟩	🟩	🟨
Cohen-Cline, Wernli, Bradford, Boles-Hall, & Grossman, 2014	🟩	🟨	🟩	🟩	🟨	🟨



RoB 2 Traffic-Light Plot (Studies 121–150)

Study	Randomisation	Deviations	Missing data	Measurement	Reporting	Overall
Cole, Young, Byrne, Guy, & Morcom, 2002	🟩	🟨	🟩	🟩	🟨	🟨
Cole, Young, Byrne, Guy, & Morcom, 2002	🟩	🟨	🟩	🟩	🟨	🟨
Cole, Young, Byrne, Guy, & Morcom, 2002	🟩	🟨	🟩	🟩	🟨	🟨
Cole et al., 2007	🟩	🟨	🟩	🟩	🟨	🟨
Cole et al., 2007	🟩	🟨	🟩	🟩	🟨	🟨
Cole et al., 2007	🟩	🟨	🟩	🟨	🟨	🟨
Denberg et al., 2005	🟩	🟨	🟩	🟨	🟨	🟨
Dietrich et al., 2007	🟩	🟨	🟩	🟨	🟨	🟨
Ferreira et al., 2005	🟩	🟨	🟩	🟨	🟨	🟨
Fitzgibbon et al., 2007	🟩	🟨	🟩	🟨	🟨	🟨
Fortuna et al., 2014	🟩	🟨	🟩	🟨	🟨	🟨
Fortuna et al., 2014	🟩	🟨	🟩	🟨	🟨	🟨
Fortuna et al., 2014	🟩	🟨	🟩	🟨	🟨	🟨
Goldberg et al., 2004	🟩	🟨	🟩	🟨	🟨	🟨
Hewitson, Ward, Heneghan, Halloran, & Mant, 2011	🟩	🟨	🟩	🟨	🟨	🟨
Hewitson, Ward, Heneghan, Halloran, & Mant, 2011	🟩	🟨	🟩	🟨	🟨	🟨
Hewitson, Ward, Heneghan, Halloran, & Mant, 2011	🟩	🟨	🟩	🟨	🟩	🟨
Hwang et al., 2013	🟩	🟨	🟩	🟨	🟩	🟨
Inadomi et al., 2012	🟩	🟩	🟧	🟨	🟩	🟧
Inadomi et al., 2012	🟩	🟩	🟧	🟨	🟩	🟧
Jandorf et al., 2013	🟩	🟩	🟧	🟨	🟩	🟧
Jandorf et al., 2013	🟩	🟩	🟧	🟨	🟩	🟧
Jensen et al., 2014	🟩	🟩	🟧	🟨	🟩	🟧
Jensen et al., 2014	🟩	🟩	🟧	🟨	🟩	🟧
Jensen et al., 2014	🟩	🟩	🟧	🟨	🟩	🟧
Katz, Fisher, Fleming, & Paskett, 2012	🟩	🟩	🟧	🟨	🟩	🟧
Levy, Xu, Daly, & Ely, 2013	🟩	🟩	🟧	🟨	🟩	🟧
Levy, Xu, Daly, & Ely, 2013	🟩	🟩	🟧	🟨	🟩	🟧
Levy, Xu, Daly, & Ely, 2013	🟩	🟩	🟧	🟨	🟩	🟧
Ling et al., 2009	🟩	🟩	🟧	🟨	🟩	🟧



RoB 2 Traffic-Light Plot (Studies 151–159)

Study	Randomisation	Deviations	Missing data	Measurement	Reporting	Overall
Ling et al., 2009	🟢	🟢	🟠	🟡	🟢	🟠
Ling et al., 2009	🟢	🟢	🟠	🟡	🟢	🟠
Marcus et al., 2005	🟢	🟢	🟠	🟢	🟢	🟠
Marcus et al., 2005	🟢	🟢	🟠	🟢	🟢	🟠
Marcus et al., 2005	🟢	🟢	🟠	🟢	🟢	🟠
McGregor et al., 2016	🟢	🟢	🟠	🟢	🟢	🟠
Myers et al., 2007	🟢	🟢	🟠	🟢	🟢	🟠
Myers et al., 2007	🟢	🟢	🟠	🟢	🟢	🟠
Myers et al., 2007	🟢	🟢	🟠	🟢	🟢	🟠

Appendix 6.3 Search Terms

MEDLINE (Ovid) search strategy terms (APA-formatted)

Step / Category	Concept	Search terms (example syntax)
Step 1	Type of Cancer	colorectal cancer.mp. OR bowel cancer.mp. OR colon cancer.mp. OR rect* cancer.mp. OR (colorectal adj2 neoplasm$).mp. OR or/1-5
Step 2	Outcomes	cancer screen*.mp. OR cancer prevention.mp. OR Health Education/ OR Health Literacy/ OR Health Promotion/ OR Health Knowledge, Attitudes, Practice/ OR Early Diagnosis/ OR Health Services Accessibility/ OR barium enema.mp. OR endoscop$.mp. OR f?ecal occult blood.mp. OR occult blood test.mp. OR self-examination.mp. OR Patient Compliance/ OR patient adherence.mp. OR treatment complicance.mp. OR patient intention.mp. OR screening intention.mp. OR screening attitude.mp.

		OR participation intention.mp. OR cancer screening intention.mp. OR or/7-27
Step 3	Intervention	Intervention Studies/ OR intervention*.tw. OR Health Promotion/ OR patient navigat$.tw. OR reminder$.mp. OR incentive$.mp. OR reduc$ cost.mp. OR Mass Media/ OR Attitude to Health/ OR Health Behavior/ OR health belief*.mp. OR health belief model.mp. OR behavio?r change.mp. OR social cognitive theory.mp. OR Persuasive Communication/ OR theory of planned behavio?r.mp. OR message fram*.mp. OR implementation intention$.mp. OR protection motivation theory.mp. OR social cognition model$.mp. OR Self Efficacy/ OR or/29-49
Step 4	Cross-cultural / equity terms	Ethnic Groups/ OR Minority Groups/ OR Cultural Competence/ OR

		Transcultural Nursing/ OR Emigrants and Immigrants/ OR Acculturation/ OR Communication Barriers/ OR cultural*.mp. OR cross-cultural.mp. OR transcultur*.mp. OR minorit*.mp. OR ethnic*.mp. OR racial*.mp. OR immigrant*.mp. OR migrant*.mp. OR (culturally adj2 adapt*).mp. OR (language adj2 barrier*).mp. OR (community health worker*).mp. OR (patient navigat*).mp.

EMBASE (Ovid) search strategy terms (APA-formatted)

Step / Category	**Concept**	**Search terms (example syntax)**
Step 1	Type of Cancer	colorectal cancer.mp. OR bowel cancer.mp. OR colon cancer.mp. OR rect* cancer.mp. OR (colorectal adj2 neoplasm$).mp. OR or/1-5

Step 2	Outcomes	cancer screen*.mp. OR cancer prevention.mp. OR Health Education/ OR Health Literacy/ OR Health Promotion/ OR Health Knowledge, Attitudes, Practice/ OR Early Diagnosis/ OR Health Services Accessibility/ OR barium enema.mp. OR endoscop$.mp. OR f?ecal occult blood.mp. OR occult blood test.mp. OR self-examination.mp. OR Patient Compliance/ OR patient adherence.mp. OR treatment complicance.mp. OR patient intention.mp. OR screening intention.mp. OR screening attitude.mp. OR participation intention.mp. OR cancer screening intention.mp. OR or/7-27
Step 3	Intervention	Intervention Studies/ OR intervention*.tw. OR Health Promotion/ OR patient navigat$.tw. OR reminder$.mp. OR incentive$.mp. OR reduc$ cost.mp. OR Mass Media/

		OR Attitude to Health/ OR Health Behavior/ OR health belief*.mp. OR health belief model.mp. OR behavio?r change.mp. OR social cognitive theory.mp. OR Persuasive Communication/ OR theory of planned behavio?r.mp. OR message fram*.mp. OR implementation intention$.mp. OR protection motivation theory.mp. OR social cognition model$.mp. OR Self Efficacy/ OR or/29-49
Step 4	Cross-cultural / equity terms	ethnic group/ OR minority group/ OR transcultural nursing/ OR cultural competence/ OR immigrant/ OR acculturation/ OR health disparity/ OR deprivation/ OR social inequality/ OR cultural*.mp. OR cross-cultural.mp. OR minorit*.mp. OR ethnic*.mp. OR racial*.mp. OR immigrant*.mp. OR

		migrant*.mp. OR (culturally adj2 adapt*).mp. OR (language adj2 barrier*).mp.

PsycINFO (Ovid) search strategy terms (APA-formatted)

Step / Category	**Concept**	**Search terms (example syntax)**
Step 1	Type of Cancer	colorectal cancer.mp. OR bowel cancer.mp. OR colon cancer.mp. OR rect* cancer.mp. OR (colorectal adj2 neoplasm$).mp. OR or/1-5
Step 2	Outcomes	cancer screen*.mp. OR cancer prevention.mp. OR Health Education/ OR Health Literacy/ OR Health Promotion/ OR health knowledge/ OR early diagnosis.mp. OR Health Services Accessibility/ OR barium enema.mp. OR endoscop$.mp. OR f?ecal occult blood.mp. OR occult blood test.mp. OR self-examination.mp. OR Patient Compliance/ OR patient adherence.mp. OR

		treatment complicance.mp. OR patient intention.mp. OR screening intention.mp. OR screening attitude.mp. OR participation intention.mp. OR cancer screening intention.mp. OR or/7-27
Step 3	Intervention	Intervention Studies/ OR intervention*.tw. OR Health Promotion/ OR patient navigat$.tw. OR reminder$.mp. OR incentive$.mp. OR reduc$ cost.mp. OR Mass Media/ OR Attitude to Health/ OR Health Behavior/ OR health belief*.mp. OR health belief model.mp. OR behavio?r change.mp. OR social cognitive theory.mp. OR Persuasive Communication/ OR theory of planned behavio?r.mp. OR message fram*.mp. OR implementation intention$.mp. OR protection motivation theory.mp. OR social

		cognition model$.mp. OR Self-Efficacy/ OR or/29-49
Step 4	Cross-cultural / equity terms	Ethnic Groups/ OR Minority Groups/ OR Cross-Cultural Treatment/ OR Cultural Sensitivity/ OR Cultural Competence/ OR Immigrants/ OR Acculturation/ OR Cultural Barriers/ OR cultural*.mp. OR cross-cultural.mp. OR minorit*.mp. OR ethnic*.mp. OR racial*.mp. OR immigrant*.mp. OR migrant*.mp.

The Cochrane Library search strategy terms (APA-formatted)

Step / Category	**Concept**	**Search terms (example syntax)**
Step 1	Type of Cancer	Colorectal cancer OR bowel cancer OR colon cancer OR rectal cancer OR colorectal neoplasm
Step 2	Outcomes	cancer screening OR cancer prevention OR Health Education OR Health Literacy OR Health

		Promotion OR health knowledge OR early diagnosis OR Health Services Accessibility OR barium enema OR endoscopy OR faecal occult blood OR occult blood test OR self-examination OR Patient Compliance OR patient adherence OR treatment compliance OR patient intention OR screening intention OR screening attitude OR participation intention OR cancer screening intention
Step 3	Intervention	Intervention Studies OR intervention OR Health Promotion OR patient navigation OR reminder OR incentives OR reduction cost OR Mass Media OR Attitude to Health OR Health Behaviour OR health belief OR health belief model OR behaviour change OR social cognitive theory OR Persuasive Communication OR theory of planned

		behaviour OR message framing OR implementation intention OR protection motivation theory OR social cognition model OR Self-Efficacy
Step 4	Cross-cultural / equity terms	ethnicity OR ethnic groups OR minority OR racial OR culturally adapted OR culturally tailored OR cross-cultural OR immigrant OR migrant OR language barrier OR translation OR interpreter OR community health worker OR health inequalities OR deprivation OR socioeconomic

Web of Science search strategy terms (APA-formatted)

Step / Category	**Concept**	**Search terms (example syntax)**
Step 1	Type of Cancer	Colorectal cancer OR bowel cancer OR colon cancer OR rectal cancer OR colorectal neoplasm
Step 2	Outcomes	cancer screening OR cancer prevention OR

		Health Education OR Health Literacy OR Health Promotion OR health knowledge OR early diagnosis OR Health Services Accessibility OR barium enema OR endoscopy OR faecal occult blood OR occult blood test OR self-examination OR Patient Compliance OR patient adherence OR treatment compliance OR patient intention OR screening intention OR screening attitude OR participation intention OR cancer screening intention
Step 3	Intervention	Intervention Studies OR intervention OR Health Promotion OR patient navigation OR reminder OR incentives OR reduction cost OR Mass Media OR Attitude to Health OR Health Behaviour OR health belief OR health belief model OR behaviour change OR social cognitive theory OR

		Persuasive Communication OR theory of planned behaviour OR message framing OR implementation intention OR protection motivation theory OR social cognition model OR Self-Efficacy
Step 4	Cross-cultural / equity terms	ethnicity OR ethnic groups OR minority OR racial OR cross-cultural OR culturally adapted OR culturally tailored OR immigrant OR migrant OR language barrier OR translation OR interpreter OR community health worker OR health inequalities OR deprivation OR socioeconomic

Appendix 6.4 Data Extraction Form

Review title or ID	
Study ID *(surname of first author and year first full report of study was published e.g. Smith 2001)*	
Report ID	
Report ID of other reports of this study	

Notes

General Information

Date form completed *(dd/mm/yyyy)*	
Name/ID of person extracting data	
Reference citation	
Study author contact details	
Publication type *(e.g. full report, abstract, letter)*	
Notes:	

Study eligibility

Study Characteristics	Eligibility criteria *(Insert inclusion criteria for each characteristic as defined in the Protocol)*	Eligibility criteria met? Yes No Unclear	Location in text or source *(pg & ¶/fig/table/other)*
Type of study	Randomised Controlled Trial	☐ ☐ ☐	
	Quasi-randomised Controlled Trial	☐ ☐ ☐	
	Controlled Before and After Study Contemporaneous data collection Comparable control sites	☐ ☐ ☐	

	At least 2 x intervention and 2 x control clusters		
	Interrupted Time Series At least 3 time points before and 3 after the intervention Clearly defined intervention point	☐ ☐ ☐	
	Other design (specify):	☐ ☐ ☐	
Participants		☐ ☐ ☐	
Types of intervention		☐ ☐ ☐	
Types of comparison		☐ ☐ ☐	
Types of outcome measures		☐ ☐ ☐	
INCLUDE ☐		EXCLUDE ☐	
Reason for exclusion			
Notes:			

Characteristics of included studies

Methods

	Descriptions as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Aim of study *(e.g. efficacy, equivalence, pragmatic)*		
Design*(e.g. parallel, crossover, non-RCT)*		
Unit of allocation *(by individuals, cluster/ groups or body parts)*		
Start date		
End date		
Duration of participation *(from recruitment to last follow-up)*		
Ethical approval needed/ obtained for study	☐ ☐ ☐ Yes No Unclear	

Notes:

Participants

	Description *Include comparative information for each intervention or comparison group if available*	Location in text or source *(pg & ¶/fig/table/other)*
Population description *(from which study participants are drawn)*		
Setting *(including location and social context)*		
Inclusion criteria		
Exclusion criteria		
Method of recruitment of participants *(e.g. phone, mail, clinic patients)*		
Informed consent obtained	☐ Yes ☐ No ☐ Unclear	
Total no. randomised *(or total pop. at start of study for NRCTs)*		

Clusters *(if applicable, no., type, no. people per cluster)*		
Baseline imbalances		
Withdrawals and exclusions *(if not provided below by outcome)*		
Age		
Sex		
Race/Ethnicity		
Severity of illness		
Co-morbidities		
Other relevant sociodemographics		
Subgroups measure		
Subgroups reported		
Notes:		

Intervention groups

Copy and paste table for each intervention and comparison group

Intervention Group 1

	Description as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Group name		
No. randomised to group *(specify whether no. people or clusters)*		
Theoretical basis *(include key references)*		
Description *(include sufficient detail for replication, e.g. content, dose, components)*		
Duration of treatment period		
Timing *(e.g. frequency, duration of each episode)*		
Delivery *(e.g. mechanism, medium, intensity, fidelity)*		

Providers *(e.g. no., profession, training, ethnicity etc. if relevant)*		
Co-interventions		
Economic information *(i.e. intervention cost, changes in other costs as result of intervention)*		
Resource requirements *(e.g. staff numbers, cold chain, equipment)*		
Integrity of delivery		
Compliance		
Notes:		

Outcomes

Copy and paste table for each outcome.

Outcome 1

	Description as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Outcome name		
Time points measured *(specify whether from start or end of intervention)*		
Time points reported		
Outcome definition *(with diagnostic criteria if relevant)*		
Person measuring/ reporting		
Unit of measurement *(if relevant)*		
Scales: upper and lower limits *(indicate whether high or low score is good)*		
Is outcome/tool validated?	☐ Yes ☐ No ☐ Unclear	

Imputation of missing data *(e.g. assumptions made for ITT analysis)*		
Assumed risk estimate *(e.g. baseline or population risk noted in Background)*		
Power *(e.g. power & sample size calculation, level of power achieved)*		
Notes:		

Other

Study funding sources *(including role of funders)*		
Possible conflicts of interest *(for study authors)*		
Notes:		

Risk of Bias assessment

See Chapter 8 of the Cochrane Handbook. Additional domains may be added for non-randomised studies.

Domain	Risk of bias Low High Unclear	Support for judgement *(include direct quotes where available with explanatory comments)*	Location in text or source *(pg & ¶/fig/table/other)*
Random sequence generation *(selection bias)*	☐ ☐ ☐		
Allocation concealment *(selection bias)*	☐ ☐ ☐		
Blinding of participants and personnel *(performance bias)*	☐ ☐ ☐	Outcome group: All/	
(if separate judgement by outcome(s) required)	☐ ☐ ☐	Outcome group:	
Blinding of outcome assessment *(detection bias)*	☐ ☐ ☐	Outcome group: All/	

(if separate judgement by outcome(s) required)	☐ ☐ ☐	Outcome group:	
Incomplete outcome data *(attrition bias)*	☐ ☐ ☐	Outcome group: All/	
(if separate judgement by outcome(s) required)	☐ ☐ ☐	Outcome group:	
Selective outcome reporting? *(reporting bias)*	☐ ☐ ☐		
Other bias	☐ ☐ ☐		
Notes:			

Data and analysis

Copy and paste the appropriate table for each outcome, including additional tables for each time point and subgroup as required.

For RCT/CCT

Dichotomous outcome

	Description as stated in report/paper				Location in text or source *(pg & ¶/fig/table/other)*
Comparison					
Outcome					
Subgroup					
Time point *(specify from start or end of intervention)*					
Results	Intervention		Comparison		
	No. with event	Total in group	No. with event	Total in group	
Any other results reported *(e.g. odds ratio, risk difference, CI or P value)*					
No. missing participants					
Reasons missing					
No. participants moved from other group					
Reasons moved					

Unit of analysis *(by individuals, cluster/groups or body parts)*			
Statistical methods used and appropriateness of these *(e.g. adjustment for correlation)*			
Reanalysis required? *(specify, e.g. correlation adjustment)*	☐ Yes ☐ No ☐ Unclear		
Reanalysis possible?	☐ Yes ☐ No ☐ Unclear		
Reanalysed results			
Notes:			

For RCT/CCT

Continuous outcome

	Description as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Comparison		

<table>
<tr><td colspan="2">Outcome</td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Subgroup</td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Time point <i>(specify from start or end of intervention)</i></td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Post-intervention or change from baseline?</td><td colspan="5"></td><td></td></tr>
<tr><td rowspan="3">Results</td><td colspan="3">Intervention</td><td colspan="3">Comparison</td><td rowspan="3"></td></tr>
<tr><td>Mean</td><td>SD <i>(or other variance, specify)</i></td><td>No. participants</td><td>Mean</td><td>SD <i>(or other variance, specify)</i></td><td>No. participants</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Any other results reported <i>(e.g. mean difference, CI, P value)</i></td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">No. missing participants</td><td colspan="2"></td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">Reasons missing</td><td colspan="2"></td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">No. participants moved from other group</td><td colspan="2"></td><td colspan="3"></td><td></td></tr>
</table>

Reasons moved			
Unit of analysis *(individuals, cluster/ groups or body parts)*			
Statistical methods used and appropriateness of these *(e.g. adjustment for correlation)*			
Reanalysis required? *(specify)*	☐ Yes ☐ No ☐ Unclear		
Reanalysis possible?	☐ Yes ☐ No ☐ Unclear		
Reanalysed results			
Notes:			

For RCT/CCT

Other outcome

	Description as stated in report/paper				Location in text or source *(pg & ¶/fig/table/other)*
Comparison					
Outcome					
Subgroup					
Time point *(specify from start or end of intervention)*					
No. participant	Intervention		Control		
Results	Intervention result	SE (or other variance)	Control result	SE (or other variance)	
	Overall results		SE (or other variance)		
Any other results reported					
No. missing participants					
Reasons missing					

No. participants moved from other group			
Reasons moved			
Unit of analysis *(by individuals, cluster/groups or body parts)*			
Statistical methods used and appropriateness of these			
Reanalysis required? *(specify)*	☐ ☐ ☐ Yes No Unclear		
Reanalysis possible?	☐ ☐ ☐ Yes No Unclear		
Reanalysed results			
Notes:			

For Controlled Before-and-After study (CBA)

	Description as stated in report/paper				Location in text or source *(pg & ¶/fig/table/other)*
Comparison					
Outcome					
Subgroup					
Time point *(specify from start or end of intervention)*					
Post-intervention or change from baseline?					
No. participants	Intervention		Control		
Results	Intervention result	SE *(or other variance, specify)*	Control result	SE *(or other variance, specify)*	
	Overall results		SE *(or other variance, specify)*		
Any other results reported					

No. missing participants			
Reasons missing			
No. participants moved from other group			
Reasons moved			
Unit of analysis *(individuals, cluster/ groups or body parts)*			
Statistical methods used and appropriateness of these			
Reanalysis required? *(specify)*	☐ ☐ ☐ Yes No Unclear		
Reanalysis possible?	☐ ☐ ☐ Yes No Unclear		
Reanalysed results			
Notes:			

For Interrupted Time Series study (ITS)

	Description as stated in report/paper		Location in text or source *(pg & ¶/fig/table/other)*
Comparison			
Outcome			
Subgroup			
Length of time points measured *(e.g. days, months)*			
Total period measured			
No. participants measured			
No. missing participants			
Reasons missing			
	Pre-intervention	Post-intervention	
No. time points measured			
Mean value *(with variance measure)*			

Any other results reported					
Unit of analysis *(individuals or cluster/ groups)*					
Statistical methods used and appropriateness of these					
Reanalysis required? *(specify)*	☐ Yes ☐ No ☐ Unclear				
Reanalysis possible?	☐ Yes ☐ No ☐ Unclear				
Individual time point results					
Read from figure?	☐ Yes ☐ No				
Reanalysed results	Change in level	SE	Change in slope	SE	
Notes:					

Other information

	Description as stated in report/paper	Location in text or source *(pg & ¶/fig/table/other)*
Key conclusions of study authors		
References to other relevant studies		
Correspondence required for further study information *(from whom, what and when)*		
Notes:		

Appendix 6.5 Study Characteristics of Included Intervention Studies (k = 119)

Study ID	Intervention Type	Intervention Setting	Contact Type	Mode of Delivery	Materials Used	Use of Reminders	Country	Study Design	Int_N	Con_N
Preston 2017	Social support (unspecified)	Research staff	remote	Individual	electronic	yes	USA	Individually RCT	110	117
(Saini et al., 2023	Information about health consequences	Research staff	in person	Individual	paper based	yes	New Jersey, USA	Individually RCT	250	173
Allgood et al., 2016	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	Bolton (incl. Bury & Rochdale), Wigan, Liverpool; North-West England, UK.	Individually RCT	11383	11445

Aragones et al., 2010	Information about health consequences	Research staff	in person	Individual	electronic	yes	NYC teaching hospital clinic	Individually RCT	31	34
Arnold 2019	Social support (unspecified)	Non-Clinically trained health staff	in person	individual	paper based	yes	rural community clinics in Louisiana	Individually RCT	251	306
Atlas 2012	Social support (unspecified)	Non-Clinically trained health staff	remote	individual	telephone based	yes	USA	Individually RCT	51071	52799
Atlas 2025 (EHR SmartLink accuracy)	Adding objects to the environment	Research staff	remote	Individual	electronic	yes	Mass General Hospital, USA	Individually RCT	1498	814

Baker et al., 2014	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	Community health center (Chicago)	Individually RCT	225	225
Barthe et al., 2015	Adding objects to the environment	Clinically trained staff	remote	Individual	paper based	yes	Paris population program	Individually RCT	1895	1527
Basch et al., 2006	Social support (unspecified)	Research staff	remote	Individual	telephone based	no	NYC health benefit fund	Individually RCT	226	230
Beach 2007	Adding objects to the environment	research staff	remote	individual	telephone based	yes	New York	Individually RCT	706	706
Beach et al 2008	Social support (unspecified)	Non-Clinically trained	remote	Individual	telephone based	yes	US	Individually RCT	706	706

		health staff								
Blumenthal, Smith, Majett, & Alema-Mensah, 2010	Information about health consequences	Clinically trained staff	in person	group	paper based	no	USA	Individually RCT	84, 98, 99	88
Boguradzka et al., 2014	Information about health consequences	Clinically trained staff	in person	Individual	telephone based	no	PCP practice, Warsaw	Individually RCT	300	300
Bourmaud et al 2023	Information about health consequences	Non-Clinically trained health staff	in person	Individual	paper based	yes	USA	Individually RCT	11657	12624
Braun et al., 2005	Information about health consequences	Clinically trained staff	in person	Individual	electronic	no	Native Hawaiian civic clubs	Individually RCT	69	52

Braun et al., 2015	Social support (unspecified)	Non-Clinically trained health staff	remote	individual	telephone based	no	USA	Individually RCT	248	242
Cameron et al., 2011	Information about health consequences	Research staff	remote	Individual	electronic	yes	Academic practice, Chicago	Individually RCT	314	314
Campbell et al 2024	Information about health consequences, Social support (unspecified)	research staff	remote	individual	electronic	yes	North Carolina churches	Individually RCT	159, 123, 176	129
Champion 2018	Social support (unspecified)	research staff	remote	Individual	telephone based,	yes	US	Individually RCT	303, 296,	305

					electronic				292	
Christie et al., 2008	Information about health consequences	Non-Clinically trained health staff	in person	individual	paper based	yes	NYC,USA	Individually RCT	13	8
Christy et al., 2013	Information about health consequences	Research staff	remote	Individual	electronic	no	Urban primary care clinics (VA & non-VA)	Individually RCT	319	340
Church et al., 2004	Adding objects to the environment	Research staff	remote	Individual	paper based	no, yes	USA	Individually RCT	434, 407	417
Clouston 2014	Social support (unspecified)	Clinically trained staff	in person	Individual	paper based	no	US	Individually RCT	1221	1174
Cohen-Cline et	Adding objects	Research staff	remote	Individual	electronic	yes	Group Health, WA State	Individuall	8005	3005

al., 2014	to the environment							y RCT		
Cohen-Cline, Wernli, Bradford, Boles-Hall, & Grossman, 2014	Information about health consequences	Research staff	remote	Individual	telephone based	yes	USA	Individually RCT	1000	3279
Cole 2017	Information about health consequences, Social support (unspecified)	Non-Clinically trained health staff	remote	individual	telephone based	yes	New York City	Individually RCT	259, 238	234
Cole et al., 2007	Adding objects to the	Research staff	remote	Individual	paper based	yes	Australia	Individually RCT	600	600

	environment									
Cole, Young, Byrne, Guy, & Morcom, 2002	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	Australia	Individually RCT	600	600
Coronado 2017	Adding objects to the environment	Non-Clinically trained health staff	remote	Individual	paper based	yes	USA	Individually RCT	21134	20059
Coronado 2018	Adding objects to the environment	Clinically trained staff	in person	group	paper based	yes	US	Individually RCT	21134	20059
Coronado et al., 2011	Adding objects to the environment	Clinically trained staff	remote	Individual	paper based	yes	Sea Mar community clinic (Seattle, Hispanic)	Individually RCT	168	165

Costanza 2007	Social support (unspecified)	Non-Clinically trained health staff	remote	Individual	telephone based	yes	US	Individually RCT	1187	1261
Cuaresma 2018	Information about health consequences	Non-Clinically trained health staff	in person	group	paper based	yes	Manitoba, Canada	Individually RCT	152	152
Davis et al 2018	Social support (unspecified)	research staff	remote	Individual	electronic	yes	Tampa Bay Community Cancer Network (TBCCN)	Individually RCT	210	206
Davis et al 2020	Adding objects to the environment	research staff	remote	Individual	telephone based	no	US	Individually RCT	285	283
DeGroff 2017	Information about health	Non-Clinically traine	remote	Individual	telephone	yes	Boston	Individuall	429	427

	consequences	d health staff			based			y RCT		
Denberg et al., 2005	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	USA	Individually RCT	386	395
Dietrich et al., 2006	Information about health consequences	Non-Clinically trained health staff	remote	Individual	telephone based	no	11 community/migrant health centers, NYC	Individually RCT	696	694
Dietrich et al., 2007	Information about health consequences	Non-Clinically trained health staff	remote	Individual	telephone based	yes	USA	Individually RCT	653	663
Dietrich et al., 2013	Information about health consequences	Non-Clinically trained	remote	Individual	telephone based	yes	NYC Medicaid Managed Care Orgs, CHCs	Individually RCT	562	1678

		health staff								
Dominic 2020	Social support (unspecified)	Research staff	in person	Individual	paper based	yes	USA	Individually RCT	156	108
Enard et al 2015	Information about health consequences	Non-Clinically trained health staff	in person	group	paper based	yes	US	Individually RCT	1044	1040
Fernaandez 2015	Information about health consequences	Non-Clinically trained health staff	in person	individual	electronic	no, yes	Texas-Mexico border	Individually RCT	173, 143	166
Ferreira et al., 2005	Information about health consequences	Research staff	in person	group	paper based	yes	USA	Individually RCT	1015	963

Fitzgibbon et al., 2007	Information about health consequences	Non-Clinically trained health staff	in person	Individual	electronic	no	USA	Individually RCT	258	728
Fortuna et al., 2014	Adding objects to the environment	Research staff	remote	Individual	telephone based	no, yes	USA	Individually RCT	158, 156, 153	157
Ganz et al., 2005	Information about health consequences	Research staff	in person	group	electronic	yes	California HMO provider orgs	Individually RCT	920	930
Gimeno-Garcia et al., 2009	Information about health consequences	Research staff	remote	Individual	electronic	no	Univ. Hospital Canary Islands, Spain	Individually RCT	79	79
Goldberg et al., 2004	Adding objects to the	Research staff	remote	Individual	paper based	yes	USA	Individually RCT	59	60

	environment									
Goldman et al., 2015	Adding objects to the environment	Clinically trained staff	remote	Individual	paper based	yes	Chicago community health centers	Individually RCT	210	210
Green et al., 2013	Adding objects to the environment	Clinically trained staff	remote	Individual	paper based	yes	Group Health, WA clinics	Individually RCT	1169	1166
Green et al., 2017	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	Kaiser Permanente WA clinic	Individually RCT	1706	1706
Gruner 2020	Adding objects to the environment	Research staff	remote	individual	paper based	no	Germany	Individually RCT	5850, 5844	5838
Guiriguet et al., 2016	Information about	Clinically	in person	group	electronic	yes	Barcelona primary care FIT	Individuall	21619	19423

	health consequences	trained staff					programme	y RCT		
Gupta et al., 2013	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	JPS Health Network, TX	Individually RCT	1593	3898
Ha et al 2014	Adding objects to the environment, Information about health consequences	Non-Clinically trained health staff	in person	group	paper based	yes	Singapore	Individually RCT	94, 83, 75	91
Hagoel 2016 (Israel)	Adding objects to the environment	Research staff	remote	Individual	telephone based	yes	Israel national CRC program	Individually RCT	9631, 9596, 9630, 9632	9602

Haverkamp et al 2020	Adding objects to the environment	research staff	in person	Individual	paper based	yes	US	Individually RCT	361	566
Hendren et al., 2013	Adding objects to the environment	Non-Clinically trained health staff	remote	Individual	telephone based	yes	Safety-net family practice, Rochester NY	Individually RCT	479	3898
Hewitson, Ward, Heneghan, Halloran, & Mant, 2011	Information about health consequences	Research staff	remote	Individual	paper based	no	UK	Individually RCT	322	322
Hirst et al., 2017	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	London CCGs (Croydon, Greenwich, Hammersmith & Fulham,	Individually RCT	4134	4135

							Hounslow, Lewisham, West London), England, UK.			
Holt et al., 2013 (African American churches)	Information about health consequences	Research staff	in person	group	paper based	no	African American churches, Birmingham (Alabama), USA	Individually RCT	152	133
Horne et al., 2015 (Navigation + PEM)	Information about health consequences	Non-Clinically trained health staff	in person	Individual	paper based	no	Community-based Medicare population (urban African Americans), Baltimore City, Maryland, USA	Individually RCT	578	642

Huf 2020	Adding objects to the environment	Non-Clinically trained health staff	remote	Individual	electronic	yes	USA	Individually RCT	220	220
Hwang et al., 2013	Social support (unspecified)	Research staff	in person	group	paper based	yes	USA	Individually RCT	153	153
Inadomi et al., 2012	Adding objects to the environment	Clinically trained staff	in person	Individual	paper based	no	USA	Individually RCT	332, 321	344
Jandorf 2013 (NYC)	Social support (unspecified)	Research staff	remote	Individual	paper based	no	Mount Sinai primary care clinics, NYC, USA	Individually RCT	181, 123	46
Jandorf et al., 2013	Adding objects to the	Non-Clinically trained	in person	Individual	paper based	yes	Mount Sinai	Individually RCT	181, 123	46

	environment	health staff								
Jean-Jacques et al., 2012 (FQHC Chicago)	Adding objects to the environment	Research staff	remote	Individual	telephone based	yes	Federally Qualified Health Center (Heartland International Health Center), Chicago, Illinois, USA	Individually RCT	104	98
Jensen et al., 2014	Adding objects to the environment	Non-Clinically trained health staff	in person	Individual	paper based	no	USA	Individually RCT	72	72
Katz et al., 2012 (Patient activation)	Information about health consequences	Research staff	remote	group	electronic	no	Federally Qualified Health Center (primary care), Columbus, Ohio, USA	Individually RCT	138	132

Katz, Fisher, Fleming, & Paskett, 2012	Information about health consequences	Research staff	in person	Individual	electronic	yes	Columbus, Ohio	Individually RCT	138	132
Krok-Schoen et al., 2015 (TIME)	Information about health consequences	Clinically trained staff	remote	Individual	paper based	no	Primary-care clinics (OSU Primary Care Network), Columbus, Ohio, USA	Individually RCT	277	251
Lairson et al 2020	Social support (unspecified)	research staff	remote	individual	electronic	yes	Indiana primary care clinics	Individually RCT	598	598
Leffler et al., 2011 (EMR reminder system)	Adding objects to the environment	Clinically trained staff	remote	Individual	telephone based	yes	Academic GI referral center (Beth Israel Deaconess Medical Center),	Individually RCT	539	291

							Boston, Massachusetts, USA			
Lemon 2013 (Patient education Iran)	Information about health consequences	Research staff	in person	group	paper based	yes	Tehran, Iran	Individually RCT	180	180
Levy et al., 2012 (Iowa provider survey)	Information about health consequences	Research staff	remote	Individual	paper based	no	Iowa family practices (Iowa Research Network), Iowa, USA	Individually RCT	187	185
Levy, Xu, Daly, & Ely, 2013	Adding objects to the environment, Information about health consequences	Research staff	remote	Individual	paper based, electronic, telephone based	yes	USA	Individually RCT	185, 186, 187	185

Lewis et al., 2012 (UNC Wave A – attending)	Information about health consequences	Clinically trained staff	remote	Individual	paper based	no	Academic internal medicine practice (UNC), Chapel Hill, North Carolina, USA	Individually RCT	168	172
Ling et al., 2009	Adding objects to the environment	Research staff	remote	Individual	paper based	no	USA	Individually RCT	133, 190, 152	124
Lo et al., 2013 (Implementation intentions leaflet)	Information about health consequences	Research staff	remote	Individual	paper based	no	NHS Bowel Cancer Screening Programme (London Hub), home-based gFOBT across London, UK	Individually RCT	12414	10768

Ma et al., 2009 (Korean American churches)	Information about health consequences	Research staff	in person	group	paper based	no	Korean churches (community-based), Philadelphia region, Pennsylvania, USA	Individually RCT	84	83
Marcus et al., 2005	Adding objects to the environment	Research staff	remote	Individual	paper based	no, yes	USA	Individually RCT	576, 530, 549	699
Maxwell et al. 2011	Information about health consequences	Clinically trained staff	in person	group	paper based	yes	US	Individually RCT	302	130
McClellan et al 2023	Adding objects to the environment	research staff	remote	Individual	paper based	yes	San Francisco, CA 94158, USA.	Individually RCT	4832	4867

McGregor et al., 2015 (BMC Cancer, England)	Adding objects to the environment	Research staff	remote	Individual	paper based	no	3 GP practices (2 London, 1 North West England)	Individually RCT	631	590
McGregor et al., 2016	Information about health consequences	Research staff	remote	Individual	paper based	yes	UK	Individually RCT	73722	76695
Miller et al., 2005 (JGIM, USA)	Adding objects to the environment	Clinically trained staff	remote	Individual	electronic	no	University-affiliated community IM clinic, Winston-Salem, NC, USA	Individually RCT	93	101
Mosen et al., 2010 (Med Care, USA)	Adding objects to the environment	Research staff	remote	Individual	telephone based	yes	Kaiser Permanente Northwest, Oregon/Washington, USA	Individually RCT	2943	2962

Myers et al., 2007	Adding objects to the environment, Information about health consequences	Non-Clinically trained health staff	remote	Individual	paper based, telephone based	yes, no	USA	Individually RCT	387, 386	387
Neter et al., 2014 (Israel, AJPM)	Information about health consequences	Research staff	in person	Individual	paper based	yes	National mailed screening program, Israel (2011 waves)	Individually RCT	13677	13878
Ornstein et al., 2010 (C-TRIP, USA)	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	Primary care practices, 19 US states	Individually RCT	21128	26676
Oyalowo et al., 2022	Adding objects to the	Research staff	remote	Individual	electronic	yes	Philadelphia, USA	Individually RCT	200	200

	environment									
Percac-Lima, 2009	Social support (unspecified)	Non-Clinically trained health staff	remote	individual	paper based	yes	USA	Individually RCT	409	814
Phillips 2015	Adding objects to the environment	research staff	remote	Individual	paper based, telephone based	no	US	Individually RCT	90, 93	88
Pignone editorial summarizing Rat et al., 2017 (France) & Singal et al., 2017 (USA)	Adding objects to the environment	Research staff	remote	Individual	paper based	yes	France (Rat); Safety-net clinics, Texas, USA (Singal)	Individually RCT	10476	10147

Preston 2017	Social support (unspecified)	Research staff	remote	Individual	electronic	yes	USA	Individually RCT	103	117
Price-Haywood et al., 2014 (JGIM, USA)	Information about health consequences	Research staff	remote	Individual	telephone based	no	5 clinics, New Orleans, USA	Individually RCT	91	67
Raine et al., 2016 (BJC, UK)	Adding objects to the environment	Research staff	in person	Individual	paper based	yes	National BCSP, England	Individually RCT	78067	90413
Ritvo et al., 2015 (Canada)	Information about health consequences	Non-Clinically trained health staff	remote	Individual	paper based	no	Group Health Centre, Ontario, Canada	Individually RCT	2629	2611
Roetzheim et al., 2004 (Cancer	Adding objects to the	Research staff	in person	Individual	telephone based	no	8 community health centers,	Individually RCT	600	596

SOS, USA)	environment						Florida, USA			
Salimzadeh 2013 (Tehran health clubs)	Information about health consequences	Research staff	in person	Individual	paper based	yes	Tehran community health clubs	Individually RCT	180	180
Selva 2019	Adding objects to the environment	Non-Clinically trained health staff	remote	Individual	telephone based	no	Italy	Individually RCT	256	256
Sepucha 2018	Adding objects to the environment	Non-Clinically trained health staff	remote	Individual	paper based	yes	Minnesota	Individually RCT	400	400
Sequist 2011 (Electronic portal messages)	Information about health consequences	Research staff	remote	Individual	electronic	no	Ambulatory centers, Massachusetts, USA	Individually RCT	552	551

Shaw 2013 (SCOPE trial, NJ practices)	Social support (unspecified)	Research staff	in person	group	electronic	no	Primary care, New Jersey, USA	Individually RCT	348	294
Simon 2010 (Automated telephone outreach)	Adding objects to the environment	Research staff	remote	Individual	telephone based	yes	Health plan, Massachusetts/New England, USA	Individually RCT	10432	10506
Slater 2018	Information about health consequences	Non-Clinically trained health staff	remote	Individual	paper based	yes	USA	Individually RCT	47195	47099
Stokamer 2004	Information about health consequences	Non-Clinically trained health staff	in person	group	paper based	yes	VA New York Harbor Healthcare System in New York City	Individually RCT	396	392

Temucin & Nahcivan, 2018	Information about health consequences	Clinically trained staff	in person	Individual	paper based	yes	Turkey	Individually RCT	52	51
Tilley 1999	Information about health consequences	Non-Clinically trained health staff	remote	individual	telephone based	yes	USA	Individually RCT	2261	2827
Tinmouth 2014 (Ontario mailed invitation)	Information about health consequences	Clinically trained staff	remote	Individual	paper based	yes	Ontario, Canada	Individually RCT	10652	10652
Tu 2006 (Chinese-American clinic)	Information about health consequences	Non-Clinically trained health staff	in person	group	paper based	no	Seattle community clinic, USA	Individually RCT	105	105

Vernon 2011 (Houston)	Information about health consequences	Research staff	remote	Individual	electronic	no	Kelsey-Seybold multispecialty clinic, Houston, USA	Individually RCT	413, 398	413
Walsh 2005	Adding objects to the environment	research staff	remote	Individual	paper based	no	USA	Individually RCT	4826	4826
Walsh 2020	Information about health consequences	Non-Clinically trained health staff	remote	individual	electronic	yes	San Francisco Bay Area Collaborative Research Network	Individually RCT	251	257
Wheeler 2020	Social support (unspecified)	research staff	remote	Individual	paper based	yes	North Carolina Medicaid enrollees	Individually RCT	8131	5533
van Roon 2011 (Netherlands	Adding objects to the	Research staff	remote	Individual	paper based	yes	Netherlands population screening	Individually RCT	2390	2394

advance letters)	environment

Note. Study ID corresponds to the first author (APA style). Int_N = intervention sample; Con_N = control sample. Multiple attributes per study are combined within cells.