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Applying the COM-B model of behaviour change to cervical screening attendance in young women.

By:

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Thank you to my friends and family for your continuous encouragement and support throughout the last three and a half years. You have celebrated my successes throughout this whole journey and shown me nothing but love and support. I hope I continue to make you all proud.

ABSTRACT

Cervical cancer, which is caused by the human papillomavirus (HPV), results in around 3,000 new cancer cases yearly in the UK. Cervical cancer rates in the UK have increased in young women over the last decade, and screening attendance has fallen to a 10-year low. As the majority of women and people with a cervix now reaching the screening age (24.5 years old) will be HPV vaccinated, research is needed to assess the impact of this successful immunisation programme on screening behaviours and further our understanding of the current barriers and facilitators to screening for both attendees and non-attendees.

In a systematic review of 106 studies looking at barriers, facilitators and factors associated with cervical screening in young women, it was found that there was an overall lack of application of theoretical models in cervical screening research. Therefore, I applied the COM-B model to a two-stage reflexive thematic analysis in a qualitative study of semi-structured interviews. This provided a more in-depth insight into the current barriers and facilitators to cervical screening. Further, a cross-sectional study found reflective motivations to be the only significant predictor of cervical screening. Using this evidence, an infographic was designed targeting motivational factors. The intention or motivation to attend cervical screening did not significantly improve. It is possible that the intervention infographic was not effective due to ceiling effects. There was some evidence to suggest that the infographic would be useful for those with neutral or negative baseline intentions to attend cervical screening.

Overall, the work in this PhD suggests that targeting reflective motivations is key to improving cervical screening attendance in young women and people with a cervix, particularly those with lower initial intentions, and that leveraging the positive impact of HPV immunisation through education can further increase uptake.

DECLARATION AND NOTE ON INCLUSION OF PUBLISHED WORK

I, Sonia Shpendi, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Means (www.sheffield.ac.uk/ssid/unfair-means). This work has not previously been presented for an award at this, or any other, university.

This thesis is in a publication format, and contains the following published work:

Chapter 2: Research presented in this chapter has been published and is available online at *Women's Health*

Shpendi S, Norman P, Gibson-Miller J, Webster R. (2025) Identifying the key barriers, facilitators and factors associated with cervical cancer screening attendance in young women: A systematic review. *Women's Health*. 2025;21. doi:10.1177/17455057251324309

Chapter 3: Research presented in this chapter has been published and is available online at *Journal of Health Psychology*

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Chapter 4: Research presented in this chapter has been published and is available online at *British Journal of Health Psychology*

Shpendi S, Norman P, Gibson-Miller J, Webster R. (2025) Cervical cancer screening attendance in young women and people with a cervix: An application of the COM-B model. *British Journal of Health Psychology.30(3)* doi:10.1111/bjhp.70016

Chapter 5: Research presented in this chapter is currently under peer review for publishing

Shpendi S, Norman P, Gibson-Miller J, Webster R. (2025) The impact of a COM-B Model infographic on intention to attend cervical cancer screening: A randomised controlled trial. (Under review)

Conference Dissemination

Chapter 2: Findings from this chapter have been presented as an oral presentation at the Division of Health Psychology (DHP) Annual Conference

> Shpendi, S (2023) Cervical cancer screening attendance in young women: A systematic review. DHP Annual Conference, Sheffield, United Kingdom

Chapter 3: Findings from this chapter have been presented in an oral presentation at the European Health Psychology Society (EHPS) Annual Conference

> Shpendi, S (2023) Cervical cancer screening in young women and people with a cervix: A qualitative study. EHPS Annual Conference, Bremen, Germany

Chapter 4: Findings from this chapter have been presented in a poster presentation at the UK Society for Behavioural Medicine (UKSBM) Annual Scientific Meeting

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Chapter 5: Findings from this chapter have been presented in an oral presentation at the Behaviour Change Conference (BCC) hosted by the UCL Centre of Behaviour Change

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Note. As this thesis follows a publication format, there is a certain degree of repetition in the background literature across the chapters.

STATEMENT OF CONTRIBUTION

The original concept for this PhD was suggested by Rebecca Webster and Jilly Gibson-Miller. Upon starting the PhD, this was further developed by myself in terms of the target population and studies that needed to be carried out. The design and materials for each study were decided by myself, with the advice of my supervisors. In the randomised control trial, a small group from the target sample contributed to the development of the infographics. All data collection was conducted by me, as well as all data analysis for all studies. Data analyses and results were then discussed with my supervisors.

I drafted all the chapters in this thesis and the manuscripts for publication, and once completed, sent them to my supervisors for comments. I then revised the Chapters accordingly. Peer-review comments from the manuscripts I submitted for publication were discussed with both my supervisors, and a plan of action on how to address them was agreed. I made the edits to the transcripts needed and gave final approval of the version of the manuscripts to be published.

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ABBREVIATIONS

Abbreviation	Meaning
ANCOVA	Analysis of Covariance
BCT	Behaviour Change Techniques
CC	Cervical Cancer
CI	Confidence Intervals
COM-B	Capability, Opportunity, Motivation - Behaviour
CON	Control Group
DELSUTH	Delta State University Teaching Hospital
eJournal	Electronic Journal
ES	Endocervical Swab
EXP	Experimental Group
GP	General Practitioner
HPV	Human Papillomavirus
HVS	High Vaginal Swab
KPSC	Kaiser Permanente Southern California
LGBT+	Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, Asexual, and Others
MMAT	Mixed Methods Assessment Tool
MoA	Mechanisms of Action
NFHS	National Family Health Survey
NHS	National Health Service
NR	Not Reported

OR	Odds Ratio
RCT	Randomised Controlled Trial
RR	Relative Risk
RTA	Reflexive Thematic Analysis
SMD	Standardised Mean Differences
UBTH	University Benin Teaching Hospital
UNVACC	Not HPV Vaccinated
VACC	HPV Vaccinated
VIA	Visual Inspection Method with Acetic Acid
VILI	Visual Inspection with Lugol's Iodine
WHO	World Health Organisation

Note. Inclusive language has been used throughout this thesis when referring to gender. The use of 'Female' aligns with APA guidelines and refers to biological sex only. This language can vary slightly across different studies; however, it has remained in line with journal and peer-review recommendations. Language has not been changed when referring to existing literature and previous research. In Chapter 3, all participants identified as women in the demographic questionnaire and therefore, this terminology was used for this paper only.

Chapter 1 Introduction

1.1 Chapter Overview

The first chapter of this thesis will provide background information on cervical cancer (CC) and cervical screening. This will include details of the NHS cervical screening programme and HPV immunisation programme that are relevant to the studies conducted in this thesis. This will also introduce the COM-B (Capability, opportunity, and motivation-behaviour) model, which is embedded in the methodology of this thesis, whilst also giving an overview of previously tested interventions targeting cervical screening uptake.

1.2 Cervical Screening

1.2.1 Cervical Cancer and Young People

Globally, CC remains the fourth most common cancer in females, with 350,000 deaths worldwide (WHO, 2023). However, the last few decades have seen a decline in incidence, partially due to improvements in the understanding of the environmental, biological, behavioural and psychological determinants of CC. In high-income countries, incidence and mortality have significantly decreased due to advances in screening and treatment options in health care settings (Falcaro et al., 2021; Rauf et al., 2023). For example, in the United Kingdom (UK), mortality rates have decreased by approximately 18% in the last decade (Cancer Research UK, 2024). This is likely due to a combination of the introduction of organised cervical screening and human papillomavirus (HPV) vaccination programmes and improvements in CC treatments (Shelton et al., 2024). In the UK, there are around 3,300 new cases of CC annually, with around 850 deaths each year. This accounts for 1% of all cancer-

related deaths in females in the UK (Cancer Research UK, 2024). As 99.8% of CC cases are preventable, this remains a public health concern in the UK and worldwide.

Cervical cancer develops when cells in the cervix (opening of the womb) change slowly over time and become abnormal, known as dysplasia. Classification for these abnormalities is based on the severity of cellular changes, ranging from low-grade to high-grade changes. Low-grade changes (Low-Grade Squamous Intraepithelial Lesions) are often less severe and have a low risk of progression to cancer. In many cases, low-grade changes will often return to normal without any treatment. High-grade changes (High-Grade Squamous Intraepithelial Lesions) are more severe and indicate a higher rate of progression to CC, with 10-20% progressing into cancer if left untreated. High-grade changes cover a larger area of the cervix tissue and involve deeper layers of cells, therefore, high-grade changes require removal treatment (Cancer Research UK, 2025). The progression of cell abnormalities to cancer can take several years and varies depending on the classification, risk factors and an individual's immune system response (American Cancer Society, 2025).

However, for all cell abnormalities, early detection is crucial for identifying abnormal cells before they become cancerous. It is possible to develop cancer at any point in a person's life and at all ages. However, according to the European age-standardised incidence rate, there has been a 34% increase in cancers in young females, as well as a 13% increase in the UK over the last decade (Cancer Research UK, 2024). In contrast, while CC incidence rates are generally higher in developing countries, this trend does not hold for younger age groups. A comparison of age-standardised CC incidence rates indicated that in England and Wales, the adjusted incidence rate for women aged 24-34 years was 27.2 per 100,000. This higher rate in countries with well-developed population-based screening programmes, such as the UK, is observed because screening typically leads to the detection of precancerous lesions and early-stage cancers at younger ages, causing incidence to increase up to age 35 years and

then stabilise at relatively low levels. This is also higher than the contemporary rate for this age group in Belem, Brazil (24.4 per 100,000) or Harare, Zimbabwe (17.0 per 100,000), which are areas that have some of the highest age-standardised CC incidence rates in the world (Peto et al., 2004; Singh et al., 2023). More recently, epidemiological studies show that CC rates are rising in young women, with the highest number of preinvasive lesions found in women aged 25-29 (Cancer Research UK, 2025). In situ, CC can develop into invasive cancer without treatment. Furthermore, the incidence rate of CC is highest in females aged 30 to 34 (Cancer Research, 2022).

1.2.2 Risk Factors and the Human Papillomavirus (HPV)

Cervical cancer has been linked to several risk and lifestyle factors, including smoking or breathing in second-hand smoke and/or reproductive factors, such as the use of oral contraceptives (National Cancer Institute, 2024). For example, smoking, high parity and use of contraceptive pills for longer than 5 years can be associated with the increased risk of lesion progression to CC (Wipperman et al., 2018). However, Human Papillomavirus (HPV) infection remains the most common risk factor (Cancer Research UK, 2018). HPV was recognised as the primary cause of CC in the early 1990s, following decades of research. Notably, virologist Harold zur Hausen published his groundbreaking study, providing definitive evidence of the role of persistent HPV infection, notably high-risk strains of HPV, such as HPV 16 and 18 (zur Hausen, 2002). This was achieved through combinations of molecular, epidemiological, and clinical research methods. Prior to this, early observations had identified the presence of HPV 16 and HPV 18 in CC biopsies (Boshart et al., 1984; Dürst et al., 1983). However, large-scale case-control and cohort studies were able to confirm these HPV strains as the strongest risk factors for CC development (zur Hausen, 2002).

These findings have been further confirmed in more recent research, with reports that HPV 16 and 18 cause 70% of CCs worldwide (National Cancer Institute, 2024). In addition, HPV 18 and HPV 45 have been associated with several cancers, including cancers of the cervix and uterus, and are more prevalent in younger women (Seoud et al., 2011).

Risk factors reported for CC are often directly or indirectly linked to acquiring HPV or the body's ability to clear the HPV infection. For example, having a weakened immune system can lower the body's ability to fight HPV infection and cause more persistent HPV infections that can progress into CC. Furthermore, sexual activity as a risk factor is also linked to acquiring HPV infection, with early age of first sexual intercourse, multiple sexual partners and a history of sexually transmitted infections all being associated with an increased risk of acquiring HPV (Cohen et al., 2019; Gravdal et al., 2021). Additionally, factors such as smoking, high parity and use of contraceptive pills for longer than 5 years can be associated with the increased risk of lesion progression to CC (Wipperman et al., 2018).

Therefore, increased incidences of CC cases in young people are thought to be related to and reflective of the increase in HPV infection and smoking prevalence in this age group (Foley et al., 2011; Ghebre et al., 2017). The ARTISTIC randomised control trial of HPV testing in primary cervical screening reported incidence of high-risk HPV positive rates around 20% in young women in the UK, and generally higher rates of HPV infection across all ages. For example, it was found that those who tested positive for HPV, as well as cytology positive (presence of abnormal or potentially cancerous cells), were significantly younger [median 28.5 years, interquartile range (IQR) 23.2–35.4 years], compared to those that were cytology-positive but HPV-negative (median 39.3 years, IQR 31.7–46.9 years, Mann–Whitney $p<0.0001$) (Kitchener et al., 2009). Similarly, Age-standardised HPV prevalence was found to peak between 25 and 35 years old and decline with age in some European countries like Italy, Spain and the Netherlands (Franceschi et al., 2006).

However, CC can remain unnoticed for years, with symptoms often only becoming noticeable later (NHS Inform, 2024). In addition, symptoms often resemble those of many other conditions or normal or abnormal hormonal cycles. For example, vaginal bleeding is one of the most noticeable physical symptoms indicating CC. Furthermore, this is often further disrupted by the common use of the contraceptive pill, particularly among younger age groups (Chang, 1989). Previous studies have shown that continued use of the oral contraceptive pill for 5 years or more enhances the risk of CC (Kamani et al., 2022). The combined contraceptive pill is the most commonly prescribed contraceptive in the UK, with over 3 million users in England and Wales (NHS Digital, 2019). Previous research has also highlighted that a significant portion of women using hormonal contraceptives, such as the oral contraceptive pill, do so for extended periods (Farrow et al., 2002). However, oral contraceptives offer protective benefits against other cancers, like ovarian and endometrial cancer, as well as being highly effective at preventing pregnancy (Cooper & Patel, 2024). It is therefore difficult to change these behaviours when focusing solely on CC. One way to combat CC and prevent it further is to attend regular screening, which is crucial for early cancer detection. CC is potentially preventable, and effective screening programmes can lead to reduced morbidity and mortality (Roope, 2021). The success of screening depends on access and uptake, quality of screening tests, adequacy of follow-up, and diagnosis and treatment of lesions detected.

1.2.3 Cervical Cancer Prevention

Cervical screening methods have evolved and changed over time. The methods adopted largely depend on a country’s economic status and access to resources, as well as the health system's governance structures and policies. For example, in the 1930s, the Visual Inspection

with Acetic Acid (VIA) method was adopted primarily in low-resource countries for early detection of cervical abnormalities. Acetic acid or iodine is applied to the cervix to detect any colour or appearance changes. This initially gained popularity due to its simplicity, low cost and immediate results. However, VIA has varied accuracy depending on the skill and experience of the healthcare provider (Wang et al., 2024). The earliest widely used method in high-resource settings was conventional cytology (Pap test). Cervical cells are collected and examined under a microscope and then examined for abnormalities. This method was more widely used in middle- and high-income countries. The Pap test provided moderate sensitivity and high specificity for detecting advanced lesions (Nkwabong et al., 2019).

1.2.3.1 NHS Cervical Screening Programme

The NHS cervical screening programme was introduced in 1988 and is a free nationwide population screening service currently for all women aged 25-65 in the UK. All of those with a cervix are eligible for screening. Previous to the establishment of the national programme, screening was opportunistic and only available during hospital visits (GOV.UK, 2024). Currently, those eligible are invited by mail to attend screening from the age of 24.5 and then every three years until age 49 and then every five years after that.

Cervical screening consists of attending an appointment where a nurse uses a speculum to obtain a sample from the cervix to be tested for HPV. In modern cervical screening, the cell sample is collected using the Liquid-Based Cytology (LBC) method, and the same vial of liquid can be used to perform both the HPV test (to detect the virus) and the LBC test (to examine the cells). If screening results are positive for HPV or an abnormality is detected,

further tests are then done (colposcopy) to further analyse for cell abnormalities (GOV.UK, 2024; NHS England, n.d.).

The LBC method was introduced in 2008 as the standard method of processing cervical samples across the UK. Prior to the LBC method, the conventional pap smear was used, where cells were smeared directly onto a glass slide. However, this method had several limitations, such as uneven cell distribution, inconsistent sample quality and a higher rate of inadequate samples, often requiring repeat testing. The introduction of the LBC method addressed these limitations by no longer smearing the cells but rather depositing the sample into a vial containing a liquid preservative. This ensured an overall more reliable method and that cells are better preserved as a result (Cancer Research UK, 2003).

In 2012, the HPV triage and test of cure (TOC) was introduced as part of the NHS cervical screening programme. This was rolled out in two phases over two years and became routine in 2014 (GOV.UK, 2024). This differed from cytology as cells were no longer examined under a microscope to detect abnormalities, but rather only examined for the presence of HPV (National Cancer Institute, 2024). It was only in instances where the presence of HPV was detected that the sample then underwent cytology. HPV triage was aimed at individuals with borderline or low-grade cervical screening results and TOC for those previously treated for cervical abnormalities. Before this, individuals with borderline or low-grade results were recalled for repeat tests in around 6 months and only referred if the abnormality persisted (Digital, 2021). HPV triage meant that those who were low risk could be reassured and not recalled for repeat testing every six months, as previously. Although this did initially result in an increase in referral rates for colposcopies, it did mean that more individuals were able to return to the standard recall (Digital, 2021; Moss et al., 2011). In 2019, primary HPV testing in England officially replaced cytology as the primary screening test.

The cervical screening invitation currently consists of a printed letter mailed to those eligible. Until recently, this was done via the NHS call and recall databases; however, in 2025, it was replaced by the NHS Cervical Screening Management System (NHS Digital, 2025). The first cervical screening invite is referred to as a "call" to initiate screening, whereas subsequent screening invitations are referred to as "recalls," depending on previous results. This system also tracks follow-up investigations and periodical recalls for those with no abnormalities. Those eligible will receive a letter from their local GP at 24.5 years of age for the first invite. Cervical screening invites are then sent periodically every three years until the age of 49, where screening is reduced to every five years until the age of 64. Those over the age of 64 years old in the UK are no longer routinely invited for screening under the NHS cervical screening programme but are still able to request screening or may continue to be invited under certain exceptions. For example, those who are over 64 years old but have an incomplete screening history (have never screened or have not been screened since age 50) or have had abnormal test results in the last three screening tests are still eligible for cervical screening after the cutoff age. The invitation letter provides brief information about cervical screening, how to book, and resources for more information. Screening invitations are also accompanied by a printed leaflet ("NHS Cervical Screening: Helping You Decide" leaflet) with further information about CC and screening (GOV.UK, 2025). Screening aims to find the presence of a disease at a stage when it can be easily treated and reduce the number of deaths from invasive CC (NHS, 2023a).

In 2004, the age for receiving a screening invitation in England was increased from 20 to 25 years old. However, in 2012, the age for sending the invitation was changed again to 24.5 years old. This change aimed to ensure that more individuals were screened by their 25th birthday, as data showed that many women were only attending screening after a second invitation, sometimes up to 6 months after the initial invitation (Castanon et al., 2021).

The NHS CC screening program in England costs approximately £175 million annually, including expenses related to the screening test, follow-up appointments, and procedures (Solihull GOV UK, 2025). In contrast, the average cost of treating CC in the NHS ranges between £ 1,379 for stage 1 cancer and £ 19,261 for stage 2 or later (NHS Northumbria Healthcare, n.d.), highlighting the financial implications and importance of early detection via screening attendance.

Cervical cancer is potentially preventable, and effective screening programmes can help reduce morbidity and mortality rates (Roope, 2021). A review by Jansen et al. (2020) of observational studies set across Northern and Western European countries found that women who attended organised cervical screening saw a 51% reduction (41% to 92%) in mortality. In contrast, among women who did not attend after the invitation, mortality reductions ranged from 17% to 79%. Therefore, it was concluded that countries with nationwide organised screening programmes had a greater reduction in CC mortalities than those that did not have screening programmes. When compared to opportunistic screening, organised screening programmes have also been shown to significantly reduce CC mortality further (Arbyn et al., 2009). In another review, when comparing the NHS cervical screening programme in England and the opportunistic screening programme in Portugal, it was found that Portugal reported 4 cases and 1 death per 100,000 women more than England annually. Analysis found that this was not due to a difference in HPV prevalence and other risk factors. Although both countries have seen a decrease in CC mortality, England has seen a significant decline in mortality rates over the last two decades (Mendes et al., 2018), partially due to the introduction of the NHS cervical screening programme. Furthermore, analysis of birth cohort trends suggested strong evidence that attending screening at a young age significantly lowered death rates throughout life (Peto et al., 2004). First-time screening attendance has been highlighted as particularly important not just for early detection, but also as initial

attendance has been shown to have a significant positive impact on the trajectory of future screening attendance, as past health-related behaviours remain one of the strongest predictors of future behaviour (McEachan et al., 2011). This highlights how early screening attendance in young women, particularly at the first invitation, has greater preventative benefits and an increased likelihood of lifelong testing.

1.2.3.2 Human papillomavirus (HPV) Immunisation Programme

As a significant proportion of CC cases are caused by HPV infection, vaccination against HPV has also become a crucial strategy for the reduction of CC (UK Health Security Agency, 2018). Furthermore, by vaccinating a large proportion of the population, herd immunity could be achieved against HPV, and therefore also indirectly protect those not vaccinated (UK Health Security Agency, 2025). However, for the vaccine to successfully reduce the burden of HPV-related diseases, vaccination availability and uptake are crucial. In the UK, vaccine coverage has fallen slightly over the years. For example, between 2022 and 2023, vaccination coverage was 4.4% lower compared to 2021 to 2022 (67.3% coverage rate), as well as 21% lower than pre-COVID-19 pandemic levels (2018 -2019) in England (UK Health Security Agency, 2024).

The HPV immunisation programme started in 2008, consisting of routine vaccination of girls aged 12-13 and a catch-up programme for females aged 14 -18 shortly after (UK Health Security Agency, 2023). The vaccination programme was later routinely offered to boys aged between 12 and 13 in 2019 (UK Health Security Agency, 2023). HPV immunisation has also been recommended for men aged 45 and under who have sex with men and other people at higher risk from HPV, such as transgender people, sex workers and people with HIV (NHS, 2023b).

An observational study on the effects of the HPV vaccination program highlighted that the introduction of the program has resulted in a steep decline in CC incidence in the UK (Falcaro et al., 2021). More recently, Falcaro et al (2024) found that the reduction in cervical cancer was the greatest in the first vaccinated cohort (those born between 1995 – 1999), with a 91% reduction in the incidence of cervical cancer compared to unvaccinated cohorts. As well as, showing an estimated 94.3% reduction in the incidence of high-grade pre-cancerous lesions (CIN3). This substantial prevention of CIN3, a key precursor to invasive cancer, translated to an estimated 83.9% reduction in the incidence of CC in the same cohort compared to unvaccinated individuals. By eliminating the source of future cancer, the HPV vaccination programme has been shown to successfully prevent disease progression (Falcaro et al., 2024).

In a broader context, a modelling study showed that widespread coverage of both HPV vaccination and cervical screening from 2020 onwards could prevent 12.5–13.4 million new cases by 2070, whilst achieving near-elimination of CC in most countries by the end of the century (Simms et al., 2019). In 2018, the World Health Organization (WHO) called for coordinated global action to eliminate CC, ensuring that 90% of all girls are vaccinated against HPV and that every woman over 30 is screened and treated for precancerous lesions (WHO, 2020). Overall, the last few decades have seen a decline in CC mortality rates in the UK, symbolising the success of the NHS cervical screening programme and HPV immunisation programme (Falcaro et al., 2021).

However, given that the HPV vaccine has been shown as only 90% preventative against CC, those vaccinated still require cervical screening to mitigate this risk further (Falcaro et al., 2021). Further, cervical screening remains central to early diagnosis, with CC being in the early stages, and 99.8% of CC cases being preventable (Roope, 2021). As the majority of women in the UK now reaching the screening age (24.5 years old) will be vaccinated (UK

Health Security Agency, 2024; Karakusevic & Foss, 2024), it is important to identify the impact of this successful immunisation on future screening behaviours and uptake.

1.3 Uptake of Cervical Screening

Despite the availability of free, effective preventative measures such as cervical screening under the National Health Service (GOV.UK, 2024), over 30% of those 25 - 49 years old in England have not attended within the recommended interval (NHS England, 2024). Cervical screening in the UK remains well below government-set targets. Currently, the NHS aims to achieve cervical screening coverage of 80% among eligible individuals. In 2024, only 68.8% of those eligible adequately attended screening within the last 3.5 years, which saw only a 0.1% increase from the previous year (NHS England, 2024). Furthermore, screening is lower among those aged 25 to 49 (71.8%) than among those aged 50 to 64 (79.4%) (NHS England, 2024). Moreover, only 57.8% of those aged 25 - 29 have been screened adequately within the previous five years, including those who had received their screening invitation for the first time.

Despite the introduction of the NHS cervical screening programme and HPV immunisation, data showed a subsequent increase in CC cases in those aged 20 to 24 years old (from 2.7 in 2012 to 4.6 per 100,000 in 2014, $p = 0.006$) (Castanon & Sasieni, 2018). The peak incidence rate of CC has been observed in the 30 to 34-year-old age group (15.2% of cases), followed by cases in people aged 25 to 29 (13.4%) (NHS England, 2023). Most of these cases are therefore diagnosed on or around first-time screening attendance, diagnosing mostly early-stage CC. However, individuals need to attend cervical screening invites to ensure these early diagnoses.

1.3.1 Improving Screening Uptake

In health psychology, interventions have played an important role in the delivery of healthcare services and the improvement of health outcomes across different patient groups and ages (Nancholas, 2024). There has been a wide range of interventions explored to improve cervical screening uptake for women of all ages. However, fewer investigations have focused on young women or first-time screeners.

1.3.1.1 Reminder and Invitation Variations

Invitation letters are currently a regular practice in the UK under the NHS cervical screening programme. Previous research has shown that receiving an invitation letter has a positive impact on screening uptake. A meta-analysis of 18 trials identified that those who received an invitation letter were more likely to attend screening when compared to those who received usual care or no invitation (RR 1., 95 % CI: 1.32 to 1.83) (Staley et al., 2021). Furthermore, cervical screening invitation letters were found to be more successful when personalised (e.g., a personal invitation or letter from the GP) (Tin et al., 2023) or featured a fixed cervical screening appointment in comparison to open screening invitation letters (Staley et al., 2021). However, when investigating a tailored cervical screening invitation letter for young women, no significant difference was found when compared to the standard screening invitation. In contrast, sending a reminder letter has been found to increase the proportion of young women attending screening (Eaker et al., 2004; McDowell et al., 1989; Morrell et al., 2005).

The use of an electronic journal (eJournal) to provide health reminders to increase the uptake of cervical screening was investigated (Wright et al., 2012). An eJournal is an interactive electronic communication and information-sharing tool. The trial found that those who received the electronic reminders had higher screening attendance when compared to those who did not. However, this was only significant when including those receiving care in a women's health centre and not significant amongst participants attending general medical practices. Therefore, an eJournal did not appear to impact screening uptake in those receiving care from general medical practices. More recently, the use of SMS and text message reminders has been found to be effective in increasing screening uptake for all ages. In 2018, text message reminders were rolled out in London GP practices, which saw a 4.8% increase in screening uptake in all age groups (GOV.UK, 2019; Huf et al., 2020). Women aged 25 - 29 were randomised to either receive a GP-endorsed text message reminder or no text message reminder. A significant difference was reported in those who had received a text message reminder (31.4%) versus those who had not (26.4%) (Huf et al., 2020). This has since become common practice within the NHS cervical screening programme across the UK.

A meta-analysis of seven trials also found that telephone invitations were effective in increasing screening uptake compared to a control group (RR 1.95, 95% CI: 1.65 to 2.30) (Staley et al., 2021). Eaker et al. (2004) also found that telephone reminders were effective in increasing screening uptake in young women. Currently, telephone invitations and reminders are not routinely used in the NHS cervical screening programme. However, when considering the cost of telephone invitations, invitation letters remain a more cost-effective choice (Staley et al., 2021). Extra costs are likely due to resources and staffing requirements needed for telephone invitations.

Lancaster and Elton (1992) tested combining breast screening invitation with cervical screening invitation. They tested whether offering cervical screening in advance with the

breast screening invitation would make a difference in uptake compared to offering opportunistic cervical screening once at the breast screening appointment. Of those who received an advance screening invitation letter, 28% attended a cervical screening compared to 13% of those who did not, indicating a significant increase in screening uptake ($p<.001$). It was reported that sending an advanced cervical screening notice alongside the breast screening invitation was preferred and did not have detrimental impacts on breast screening uptake.

However, cervical screening is one of the first health screening programmes young women will be invited to in the UK, therefore, there are limited options for offering cervical screening alongside other services. One option has been offering opportunistic screening at sexual health clinics alongside STD testing. This has been commissioned in London and some regions in the UK for those overdue for their screening (Mackie, 2017). However, as cervical screening in the UK is commissioned and paid for by the government, there are economic and policy barriers to ensuring that screening services in sexual health clinics are correctly commissioned. Although cervical screening can be accessed at some UK sexual health clinics, it is not known whether this has had a significant impact on screening uptake and whether the service will be expanded across further sexual health clinics.

1.3.1.2 HPV Self-sampling

More recently, the development of HPV self-sampling has been increasingly explored for possible roll-out. Self-sampling would address barriers to screening relating to dislike and negative associations, such as embarrassment and pain related to having gynaecological exams, as well as not requiring the need to book an appointment. The recent YouScreen trial

(Lim et al., 2024) tested the use of HPV self-sampling by sending out or offering test kits to those at least six months overdue for cervical screening. Participants could either take the test in the clinic or at home and send it back to the laboratory. However, this method of screening remains in the early stages, with mixed results on the success of HPV self-sampling in increasing screening uptake and how best to offer self-sampling as a choice (Lim et al., 2024). The HPValidate study was set up by the UK National Screening Committee as an initial step to identify the accuracy of HPV self-sampling in comparison to standard clinical testing (Marlow et al., 2024). Study findings found that HPV self-sampling did have potential to meet the validation requirements of sampling accuracy, but further evaluation would be needed in the context of screening in England and therefore could not directly compare the accuracy in comparison to current clinical testing (Mathews et al., 2024). However, it was found that user acceptability of self-sampling was generally positive among participants (Marlow et al., 2024). A meta-analysis of 33 papers reporting on women aged 30 - 60 years old suggested that women were twice as likely to uptake cervical screening using self-sampling than compared to standard screening methods (Relative Risk (RR) = 2.13, 95% Confidence Interval (CI) 1.89–2.40), however, had no significant impact on follow-up rates for those who tested positive (RR = 1.12, 95% CI 0.80–1.57) (Yeh et al., 2019). However, the meta-analysis also identified that mailing self-sample kits was the most effective approach for distributing the self-sampling kits (RR: 2.27, 95% CI 1.89 to 2.71) compared to 'on-demand' requesting a self-sampling (RR: 1.28, 95% CI 0.90 to 1.82). Whereas the YouScreen Trial found opportunistically offered self-testing kits in-person (65.5% returned) to be more effective than directly mailed kits (12.9% returned) (Lim et al., 2024).

Moreover, the STRATEGIC trial (Kitchener et al., 2016) tested the use of HPV self-sampling as part of a cluster randomised trial embedded in the NHS Cervical Screening Programme focusing on first-time cervical screening invitation. In the first phase, women

were randomised over 18 months into those who would receive a pre-invitation leaflet six weeks before the standard invitation or the routine invitation alone. Women in one of the locations (Manchester, United Kingdom) were also provided with access to an online booking system in an attempt to overcome the barrier of inconvenience booking an appointment. This was available to all participants, regardless of whether they were in the intervention or control groups. In the second phase, non-attenders were further randomised into interventions designed to address possible barriers to screening. This included vaginal HPV self-sampling (at the request or sent unrequested), timed appointments, access to a nurse navigator or a choice between a nurse navigator or HPV self-sampling. Self-sampling and timed appointment interventions were found to lead to a small but significant increase in screening uptake. In contrast, neither the pre-invitation leaflet nor online booking had any impact on cervical screening uptake (Kitchener et al., 2018). Furthermore, a recent systematic review that conducted an economic analysis of cervical screening interventions from the STRATEGIC trial found that self-sampling and timed appointments are highly likely to be cost-effective (Tsiachristas et al., 2018). Another UK-based RCT also found that receiving a self-sampling kit had a significantly higher response rate in long-term non-responders than receiving a normal screening invitation (10.2% vs 4.5%) (Szarewski et al., 2011). However, this study acknowledged that screening attendance rates are particularly low in women aged 25 - 29 years old, and the study included only a small percentage of participants aged 35 or younger (5.7%). This is likely due to self-sampling interventions currently predominantly targeting non-attenders, which can be harder to determine early in screening eligibility, and therefore emphasises that the barriers to screening have not been fully explored in this age group.

Further, one study identified that teenagers and young women expressed a preference for clinician-collected samples instead of self-sampling. This came with suggestions that

young women expressed an overall lack of confidence in their abilities to self-sample and had little trust in self-sample results (Madzima et al., 2017). As such, evidence of the effectiveness and feasibility of self-sampling amongst young women is currently limited.

1.3.1.3 Educational Materials

Educational interventions often consist of various formats and are presented in printed or electronic formats. Previous reviews have yielded mixed reports of the effectiveness of educational materials. For example, a meta-analysis of 13 trials showed an increase in the uptake of screening in those who received printed educational materials compared to those in the control groups (RR 1.35, 95% CI 1.18 to 1.54; Staley et al., 2021). However, another review of CC screening in low - and middle-income countries reported that it remained unclear as to whether health education and/or brochures impacted screening attendance. This was due to the overall low to very low certainty of evidence based on the Grading of Recommendations, Assessment, Development, and Evaluation system, meaning the true effect may be different or substantially different from the reported estimated effect (Tin et al., 2023).

Previous research has also reported only a small difference in screening uptake when individuals received printed educational materials and health clinic invitation letters (RR 1.08, 95% CI: 0.45 to 2.61; Bowman et al., 1995). Bowman et al. (1995) also found no difference in screening uptake between those who received printed materials and GP invitation letters. Nonetheless, printed educational brochures are now typically included in the standard NHS cervical screening programme invitation protocol. All invitees receive an invitation letter and a “Cervical screening: helping you decide” leaflet. A recent study by

Charlton and Rodrigues (2024) investigated how the NHS leaflet was interpreted and viewed by those approaching screening age. It was found that interpretation difficulties were common, particularly regarding HPV assessment, screening results, additional tests/treatment, and screening risks. In addition, research by Adab et al. (2003) found that including extra information about the risks, uncertainties, and benefits of screening could deter some from attending the screening. This highlights the complexity of designing informative educational materials while encouraging screening attendance. Furthermore, acknowledging where there may be a lack of research-based practice in the NHS.

School-based health education has also been explored as a potential environment for targeting young women. A recent review of 13 randomised controlled trials identified that one-off or brief educational intervention provided to students could improve knowledge of CC, HPV infection and HPV vaccination (Random effect: SMD = 1.15, 95% CI: 0.67–1.63). However, in the four trials reporting risk perceptions of CC and HPV infection, uncertainty remains around whether school-based educational interventions improve risk perceptions (Random effect: SMD = 0.21, 95% CI: −0.15- 0.57; Ampofo et al., 2022). Nonetheless, it is important to note that in this review, only one of the included 13 studies was judged as having an overall low risk of bias using the Cochrane risk of bias tool for randomised trials.

As technology has become more advanced and accessible, particularly for those in higher-income countries, digital formatting for educational materials has become increasingly popular and viable. In previous research, young women have often expressed preferences for digital formatting over printed materials (Charlton & Rodrigues, 2024). A growingly popular digital format for educational materials and reminders has been an infographic. An infographic is an abbreviation for an information graphic that visually represents information, often including pictures, text, and data (Krum, 2013). Previous studies have demonstrated that infographics can enhance understanding of and engagement with health information

(McCrorie et al., 2018; Spiegelhalter et al., 2011) and increase knowledge and behaviour (Kong et al., 2025). A recent randomised controlled trial found that a generic infographic about cervical screening significantly increased participants' intentions and beliefs about cervical screening when compared to a control infographic, unrelated to cervical screening (Waite et al., 2023). However, this remains under-researched in the area of cancer screening and cervical screening, specifically in young women.

1.3.2 Theoretical Approach

Most interventions that have sought to increase the uptake of cervical screening have not drawn on a theoretical framework. The use of theory to inform the design of health behaviour interventions is likely to increase their effectiveness (Michie et al., 2018). For example, Mishra et al. (2009) reported the use of a theory-guided educational program to improve cervical screening uptake in Samoan women. Although the programme was found to significantly increase knowledge, the study failed to clearly report the details of the theory used and how this was used. Furthermore, a population-based cross-sectional survey conducted in Ghana designed and tested a video-based educational intervention using the Health Belief Model and the Transtheoretical Model (Drokow et al., 2021). The study found that the intervention significantly increased knowledge of CC, screening and risk factors. However, the paper reported this as a significant increase in individual item responses and did not report average knowledge scores for each area. Therefore, it remains unclear whether there was a significant difference in overall knowledge of CC, screening, or risk factors.

In regard to infographics, a content analysis of multiple online infographics targeting healthy eating was conducted by Wilkinson et al. (2016), which identified an overall lack of theoretical constructs included in the infographics. For example, only around half of the

infographics provided behaviour capability constructs, such as tools and resources on how to make the new behaviour easier to perform. Wilkinson et al. (2016), therefore, called for the increased implementation and dissemination of theoretical elements in health-related infographics. A recent randomised controlled trial by Waite et al. (2023) used the behaviour change wheel and the COM-B model of behaviour change to guide an infographic design. In this case, the infographic targeted reflective motivation and psychological capability to target CC screening behaviours. It was found that presenting participants with a generic infographic about cervical screening resulted in significantly higher intentions to screen and more positive beliefs about screening benefits when compared to a control infographic (unrelated to cervical screening). However, other than the Waite et al. (2023) study, there is a lack of research on infographics to encourage the uptake of cervical screening and no research to date on the impact that infographics may have on young women, particularly those at first-screening age.

1.3.2.1 COM-B Model of Behaviour Change

Although there are several relevant theoretical models and approaches which could be applied to the field of cervical screening, the COM-B (Capability, Opportunity, Motivation, and Behaviour) Model of Behaviour Change (Michie et al., 2011) has been used to provide the overarching theoretical framework for the research presented in this PhD. The COM-B model covers a much broader range of determinants of behaviour when compared to the narrower focus social cognitive models, such as the Theory of Planned Behaviour (Ajzen, 1991) and the Health Belief Model (Rosenstock, 1974). The flexibility and applicability of the COM-B model to a wide range of behaviours and contexts also allowed the project to develop naturally without being restricted to a particular domain. Furthermore, the COM-B identifies a clear path to intervention design as it can be used to identify specific factors that

can be targeted for intervention through the use of specific behaviour change techniques (Michie et al., 2018).

The COM-B model is designed to provide an overarching framework that captures all factors that influence behaviour change (Michie et al., 2011). The COM-B model states that behaviour is the outcome of three components (see Figure 1.1). The first component, *Capability*, considers whether individuals have the knowledge, skills and abilities required to engage in the behaviour. This includes both psychological capability and physical capability. Psychological capability includes knowing how to perform the behaviour and the necessary mental skills, such as decision-making skills and memory. Physical capability is an individual's ability to perform the behaviour physically, including having the strength and stamina to do so. The second component, *Opportunity,* focuses on the external factors that make the execution of a particular behaviour possible. This includes physical opportunities as well as social opportunities. Physical opportunities refer to the environment where the behaviour would take place, but also have the necessary resources, like time and money. Social opportunity involves external influences, like social networks, the behaviours of others and cultural norms. The third component, *Motivation*, refers to the internal processes that influence our decision-making and behaviours. This includes reflective motivation and automatic motivation. Reflective motivation refers to reflective processes such as conscious thought, beliefs, attitudes or goals. Whereas automatic motivation involves subconscious emotions and habits.

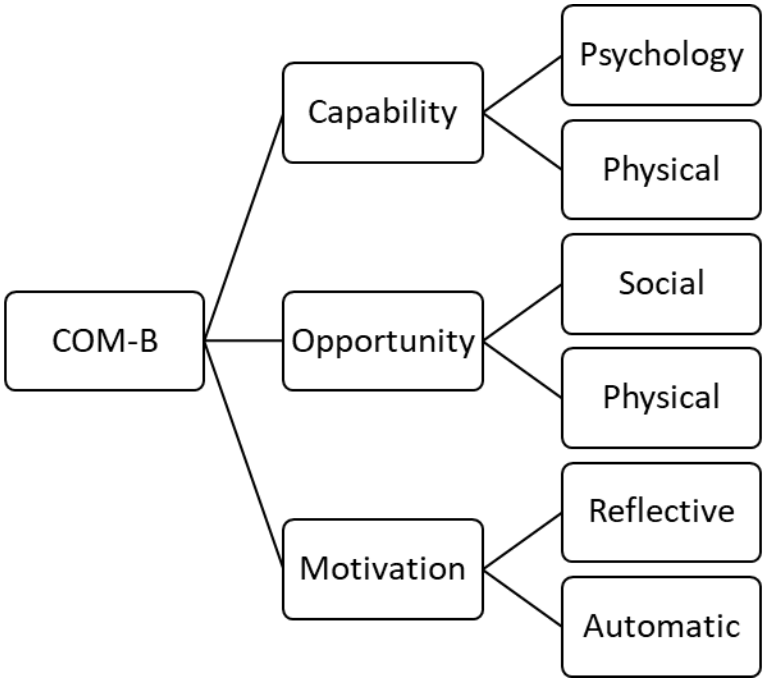

Figure 1.1 The COM-B model - a framework for understanding behaviour

The COM-B model has also since been further developed with optional layers of further understanding behaviour, such as the Theoretical Domains Framework (TDF). The TDF consists of 14 domains classed as essential for behaviour change that are mapped onto related COM-B components (Atkins et al., 2017). Both the COM-B model alone or with TDF allow researchers to diagnose clear barriers and facilitators of a behaviour. To then develop this further and create relevant interventions, researchers can use the Behaviour Change Wheel (BCW) to understand the intervention functions required for each COM-B component and how best to deliver the intervention (Michie et al., 2011). This is also paired with the Behaviour Change Techniques (BCTs) taxonomy, which can then inform specific intervention content depending on the relevant COM-B components (Michie et al., 2015).

The COM-B model takes a holistic approach, emphasising that behaviour results from the interaction of these three components. Interventions that target one or more of these components are recommended to deliver and maintain effective behaviour change. Given that

researchers in cervical screening behaviours are yet to establish a conclusive theoretical framework, the COM-B model may help facilitate the identification of relevant factors to cervical screening behaviours in young women, as well as guide intervention development.

The COM-B model has been applied previously to various research of different methodologies in cancer research. For example, a systematic review and meta-analysis examined the effectiveness of patient educational interventions for reducing cancer pain intensity in cancer patients (Marie et al., 2013). Reviewers applied the COM-B model as a framework to classify and compare interventions. It was concluded that interventions targeting all three COM-B components were most effective, however, subgroup effect analysis, comparing the effects of interventions using only one component, was not significant. Although motivational components were most used across the included interventions (Marie et al., 2013). In cross-sectional surveys, the COM-B model has been used in both survey development and analysis. A recent cross-sectional study utilised the COM-B model to construct a theoretical model of cancer patients' involvement in treatment decision-making. The study found that self-efficacy, health literacy and health professionals' decisional support were key in enhancing patient involvement in treatment decision-making, suggesting that findings support the potential of the COM-B model's explanatory potential (Xiao et al., 2023).

Furthermore, the COM-B model has been a successful tool in the analysis of qualitative data. In a study aiming to understand the beliefs and behaviours of NHS GPs in the practice of diagnosing cancer, to inform the ThinkCancer! Intervention development. Generated subthemes were mapped onto the COM-B model and further identified in the theoretical domains framework. The study highlighted commonly overlooked dynamics and tensions that GPs experience in individual decision-making, mapped onto Capability and Motivation, as

well as external considerations of the impacts of secondary care on GP decision-making (Opportunity; Hiscock et al., 2024).

1.4 Rationale and outline of the research

In summary, HPV is the primary risk factor for CC, and cervical screening remains essential for HPV detection and early CC diagnosis. However, in young women, screening uptake has been especially low. Alternative screening strategies, such as self-sampling, are still in the early stages of development. Although HPV immunisation offers effective protection, its impact on screening attendance is not yet fully understood, making attendance at screening appointments the most effective method for early detection and diagnosis of CC. Interventions designed to improve screening uptake have demonstrated variable effectiveness and are frequently not grounded in behavioural theories. Consequently, there remains a significant gap in the literature regarding the application of behavioural theories, such as the COM-B model, to enhance our understanding of cervical screening behaviour in young women and to inform the development of evidence-based interventions.

1.4.1 Aims

The overarching aim of this PhD is to generate evidence to identify factors associated with attending cervical screening in young women. This will include exploring what barriers and facilitators are frequently associated with cervical screening attendance, in order to develop an intervention designed to improve attendance. The PhD will also consider the

impact of the HPV immunisation programme, as the majority of those at screening age will now be HPV vaccinated.

1.4.2 Research Questions

1. What are the current barriers and facilitators to cervical screening in the UK?

2. What factors are associated with attending cervical screening in the UK?

3. What impact does the HPV vaccination have on decision-making to attend cervical screening in the UK?

4. Do infographics as part of a behaviour change intervention improve intention to attend cervical screening?

1.5 Organisation of the Thesis

Chapter 1 (Introduction) provides some relevant background information about CC and current screening and HPV immunisation. This section also evaluates previous interventions to increase the uptake of cervical screening and introduces the theoretical framework that will be used across the thesis.

Chapter 2 presents a systematic review that explores and reviews current literature on the barriers, facilitators, and factors associated with cervical screening attendance among

young women worldwide. This has been published in Women's Health (Shpendi et al., 2025a; doi: 10.1177/17455057251324309). Given the paucity of research on factors associated with cervical screening in young women conducted in the UK, it was decided to include both national and international papers. Furthermore, understanding barriers, facilitators, and factors associated in general is important for understanding how this may or may not relate to young women in the UK. The COM-B model was used to interpret the key barriers, facilitators, and factors associated with cervical screening attendance in young women.

Chapter 3 presents the methodology and findings of a qualitative study exploring barriers and facilitators as experienced by young women in the UK who have and haven't attended cervical screening. This study has been published in the Journal of Health Psychology (Shpendi et al., 2024; doi: 10.1177/13591053241281405). The findings from this study build on Chapter 2 by focusing on barriers and facilitators specific to young women in the UK. The interview data were analysed using reflexive thematic analysis and interpreted using the COM-B model, in line with the systematic review presented in Chapter 2.

Chapter 4 presents the methodology and findings of a cross-sectional study that examined associations between COM-B components and cervical screening attendance in young women in the UK. The design of the study was informed by the results of the systematic review and the qualitative study. The study was able to assess the strength of relationships between COM-B components as identified in the systematic review and the qualitative study, and attendance (or non-attendance) behaviour. The study also analysed the association between HPV vaccination and cervical screening attendance.

Chapter 5. Presents the methodology and findings of a randomised controlled trial analysing the impact of an infographic on intention to attend cervical screening in young women. The design of the infographic was informed by the findings of the previous studies

presented in the thesis and primarily targeted factors related to the motivation component of the COM-B model. This study recruited participants within 6 months of screening invitation (23 years old) who had not previously attended cervical screening.

Chapter 6 discusses the key findings from the research presented in this thesis and how the findings relate to existing literature. As this thesis is aimed at improving cervical screening uptake, this section presents strong justifications for the contribution of knowledge this thesis sought to achieve while highlighting the research's theoretical and practical implications. This section also covers the strengths and weaknesses of the studies included in this thesis and suggests recommendations for future research.

Chapter 2 A systematic review of barriers, facilitators and factors associated with cervical screening in young women

2.1 Introduction

There are around 604,000 new cases of cervical cancer (CC) a year globally (World Health Organisation, 2023). CC has been linked to several risk and lifestyle factors, such as sexual history and smoking (Cancer.org, 2020), with persistent Human Papillomavirus (HPV) infection remaining one of the most common causes of CC (Bedell et al., 2020). In 2018, the World Health Organisation (WHO) called for coordinated global action to eliminate CC, ensuring that all girls are vaccinated against HPV and that at least 70% of women be screened by the age of 35(World Health Organization, 2020). The last few decades have seen a decline in mortality rates of CC, with cervical screening programmes and HPV immunisation programmes supporting this (Falcaro et al., 2021; Rauf et al., 2023). However, uptake rates for both the HPV vaccination and screening have been decreasing over recent years, particularly in young women (NHS Digital, 2021; Roland et al., 2013; UK Health Security Agency, 2022), whilst CC remains a health concern for both low- and high-income countries (Anorlu, 2008; Cancer Research, 2022; Garland et al., 2008).

Although cervical screening guidelines vary slightly across different regions, they typically recommend that screening should start between the ages of 20 – 30 years old. However, first-time attendees and young women often face challenges in attending CC screening, such as difficulties making appointments, time constraints and perceived low priority (O'Donovan et al., 2021; Waller et al., 2009). Previous research has also indicated the positive impact of past behaviour on intention and future health behaviours (Ferguson & Bibby, 2002; Hodgkins & Orbell, 1998), underscoring the importance of initial screening

attendance and experiences and the effect on subsequent screening attendance. In order to improve screening rates, it is important to identify the key facilitators of and barriers to CC screening in young women who are attending screening for the first time.

A previous systematic review (Kirubarajan et al., 2021) identified various barriers and facilitators to CC screening in women under 35 years old. Common barriers included: lack of knowledge/awareness, negative perceptions of testing, and practical barriers. Common facilitators included increasing knowledge and awareness, trusting relationships with healthcare providers, and specific improvements to overcome logistical barriers to screening. However, a gap remains regarding understanding the full range of factors associated with screening attendance in this age group, including socio-demographic or psychological factors, as well as the identified perceived barriers/facilitators themselves. In addition, initial cervical screening is most commonly recommended to 25–29-year-olds, across both high and low-income countries (Bruni et al., 2022), hence focusing on those 30 years old and under is likely to better capture initial screening behaviours. The previous review (Kirubarajan et al., 2021) also only included studies that explicitly mentioned an age cut-off in the title/abstract, which may have resulted in the exclusion of potentially relevant studies. Moreover, as a large portion of women now reaching the screening age are likely to have been vaccinated (or offered the vaccine) (Colzani et al., 2021; UK Health Security Agency, 2022), it is important to also assess the possible impact of the immunisation programme on first-time screening behaviours.

The current systematic review therefore aims to systematically categorise a wide range of factors, including vaccination status, which may impact screening in young women who are first-time screening participants.

2.2 Methods

The reporting of this review adheres to the standards for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Moher et al., 2010). Methods of the analysis and inclusion criteria were specified in a pre-registered protocol (PROSPERO CRD42022324948). PRISMA guidelines were followed when preparing this manuscript (Moher et al., 2010).

2.2.1 Search Strategy

SS and RW tested a variety of different search strategies to find balance in the specificity and sensitivity of the terms. These were finalised in discussion with JGM. The final search strategy used terms and associated words for 'Human papillomavirus', 'Cervical Cancer' and 'Screening' (see Appendix A). The search strategy was modified for each specific database due to differences in MeSH terms and Boolean operators.

2.2.2 Searches

The following electronic databases were searched: Web of Science, MEDLINE, Scopus, PsychINFO and PyschARTICLES) and CINAHL. No grey literature was searched.

2.2.3 Review Process

SS and RW tested the screening process for one database prior to the full database search. SS carried out a full search on December 20, 2021 (updated June 1, 2023). The searches were combined using Mendeley, with duplicates identified and deleted. First, titles

and abstracts were screened for mentions of barriers, facilitators and/or factors associated with cervical screening in an under-30-year-old majority sample (i.e., >50%). If this was not clear in the abstract, the study was taken to full-text review. Second, all full-text papers were screened in relation to the exclusion/inclusion criteria. Authors were contacted directly in instances where the full-text paper was not readily available. If no response was received after two contact attempts, studies were excluded. RW screened 15 of the full-text papers screened by SS to ensure consistency in inclusion. Any disagreements were discussed with JGM. Similarly, if the age of the sample was not clear in the reported study, authors were contacted directly, and studies were included or excluded accordingly. Forward and backward citation searches were also carried on papers that met the inclusion criteria.

2.2.4 Selection Process

Studies were eligible for inclusion if they met the following criteria:

- *Population*. Females aged 30 years old or under.
- *Exposure.* Cervical screening including invitation and/or attendance behaviour.
- *Outcome.* The study reported data on barriers AND/OR facilitators to cervical screening AND/OR factors associated with cervical screening.
- *Study design.* Both qualitative and quantitative studies were eligible. Quantitative studies could be of any design. Articles that did not report on original data, e.g., reviews or editorials, were excluded.
- *Other limiters:* Published in the English language.

Outcome definitions:

- Barriers to cervical screening: reported obstacles or circumstances that hinder cervical screening attendance

- Facilitators to cervical screening: reported aids or circumstances that promote cervical screening attendance
- Factors associated with cervical screening: these could be a range of barriers, facilitators or personal characteristics that have been quantitatively assessed and found to be statistically associated with cervical screening attendance

2.2.5 Data Extraction

Data from the final set of studies were extracted by SS and included: author (year of publication), country, design, population description (sample size and sample description), age, type of screening, outcomes, reported facilitators, reported barriers, factors associated with screening behaviour.

2.2.6 Quality Assessment

The quality of included studies was assessed using the Mixed Method Appraisal Tool (MMAT) (Hong et al., 2018). This was used for all study designs included (quantitative, qualitative, and mixed methods). The original "yes", "unclear" or "no" answers were used. Eleven (10%) of included studies were quality assessed by a second researcher and scores agreed with SS.

2.2.7 Data Analysis

Heterogeneity in study designs and outcomes was expected, therefore we did not plan for any meta-analyses and instead used a narrative synthesis. As there is no consensus on the best way to carry out a narrative synthesis for systematic reviews (Popay et al., 2006), we used a weight-of-evidence approach in which the quality of studies was considered when

assessing the strength of evidence. The narrative synthesis reports on study characteristics (e.g., author, year, country of origin and setting), study design (e.g., design, outcomes measures used, and methodology included), participant characteristics (e.g., age and sample size) and results relevant to the chosen outcomes.

2.3 Results

2.3.1 Search Results

Searches yielded a total of 26,120 papers, of which 12,978 papers were excluded after removal of duplicates and an additional 44 papers were identified through reference list searches and 1,929 papers through forward citation searches, resulting in 15,115 papers for title and abstract screening. Following this initial screening process, 692 full-text papers were screened. In total, 106 papers were included in the systematic review.

Papers were excluded for several reasons (n = 586) including, the majority of participants being over 30 years old (n = 397), accurate data regarding participants' age not available (n = 97), not reporting barriers, facilitators or factors associated with screening (n = 37), full-text papers not being available (n = 36), no English version being available (n = 7), the inclusion of the wrong target population (e.g., male participants) (n = 5), being an intervention based only study (n = 3), being grey literature (n = 3), and not being an original research article (n = 1) (see Figure 2.1).

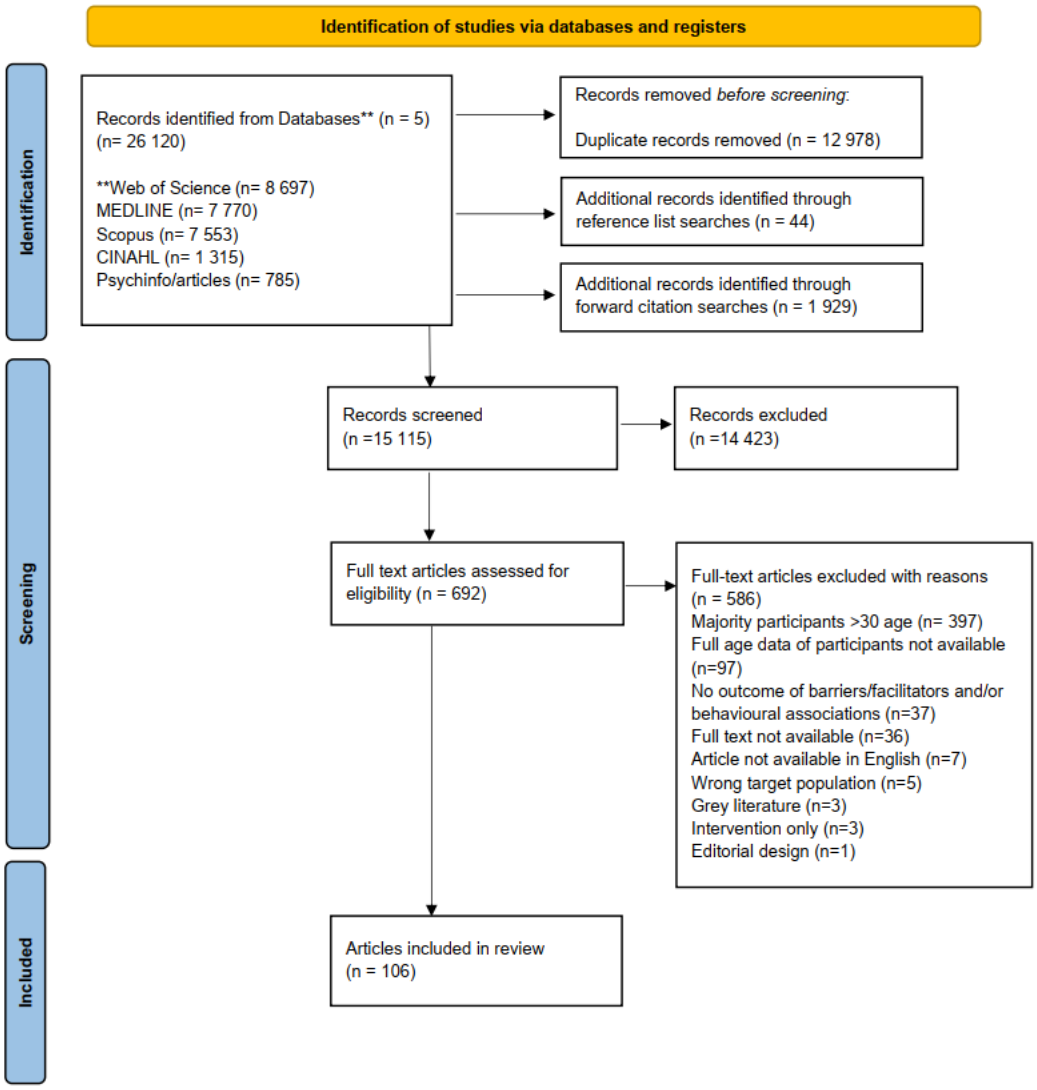

Figure 2.1 PRISMA flow Diagram

2.3.2 Article Characteristics

Studies were published between 1996-2024. The majority employed quantitative and observational methods (n = 85), including questionnaires and surveys (n = 74), cohort studies (n = 5), case-control studies (n = 1), mixed-methods (n = 3), quasi-experimental (n = 1) and RCTs (n = 1). The mixed-methods studies comprised a cross-sectional survey with

interviews (*n* = 2) as well as a cross-sectional survey with focus groups (*n* = 1). Other studies used qualitative methods (*n* = 10; interviews *n* = 2, focus groups *n* = 6, and both *n* = 2), utilised secondary data (*n* = 7) or were retrospective (*n* = 4).

The largest portion of the studies were conducted in Africa (*n* = 44; Nigeria, Ethiopia, Malawi, South Africa, Bhutan, Ghana, Kenya, Uganda, Zimbabwe and Lesotho); 30 were conducted in North America (USA, Canada and Dominica); 19 in Asia (India, Singapore, Japan, Malaysia, Nepal, Saudi Arabia, Pakistan, Thailand, Korea and Oman); eight in Europe (United Kingdom, Sweden and Greece); five in Oceania (Australia); and one in South America (Brazil).

The sample size of included studies ranged from 12 to 699,686. Almost half of included studies targeted student populations (42/106, 39.62%). Most studies discussed Pap smears specifically (75/106, 70.75%), whereas 11 papers also discussed Visual Inspection with Acetic Acid (VIA), four papers HPV testing, two Visual Inspection with Lugol's Iodine (VILI) and one paper Liquid-Based Cytology, High Vaginal Swab and Endocervical Swab, as well as Pap smears. Six studies focused solely on VIA methods of screening. Twenty-three studies did not specify a particular type of screening. Sixty-six studies included details on barriers to screening, 18 on facilitators of screening and 74 on factors associated with screening. See Table 2.1 for full study characteristics and Table 2.2 for summary of reported themes.

Table 2.1 Study Characteristics

Reference, year published	Country	Study Design	Sample size; Sample description	Average age (SD)	Type of Screening	Outcome(s)
Abiodun et al., 2014	Nigeria	Quasi-experimental	614 Women	NR (majority 25-34, EXP 72.3% & CON 70.3%)	VIA	Barriers
Abotchie & Shokar, 2009	Ghana	Cross-sectional survey	140 University students	NR (age range 18-35, majority 21-25, 66.2%)	Pap smear	Barriers
Ackerson et al., 2008	USA	Qualitative Interviews	7 African American women	28 (SD NR)	Pap smear	Barriers, Facilitators
Ackerson et al., 2014	USA	Cross-sectional survey	67 Undergraduate female nursing students	23 (4.78)	Pap smear	Barriers, Factors associated
Akpo et al., 2016	Dominica	Cross-sectional survey	100 Female medical students	NR (age range 15-29)	Pap smear	Barriers
Akujobi et al., 2008	Nigeria	Cross-sectional survey	220 University students	23.8 (SD NR, age range 17-39)	Pap smear	Barriers
Al-Naggar et al., 2010	Malaysia	Cross-sectional survey	285 University students	20.9 (1.89)	Pap smear	Barriers
Alwahaibi et al., 2017	Oman	Cross-sectional survey	494 Outpatients, Hospital staff and students	NR (age range NR, majority 20-30, 68.6%)	Pap smear	Barriers, Facilitators, Factors associated
Alwahaibi et al., 2018	Oman	Cross-sectional survey	494 Outpatients, Hospital staff and students	NR (age range </20 majority 20-29, 68.2%)	Pap smear	Factors associated
Anaman et al., 2017	Australia	Cross-sectional survey	254 African-born women	NR (majority 21-29, 52%)	Pap smear	Facilitators, Factors associated
Aniebue et al., 2010	Nigeria	Cross-sectional survey	394 Hostel residents	23.8 (3.8)	Pap smear	Barriers, Facilitators, Factors associated

Anikwe et al., 2021	Nigeria	Cross-sectional survey	325 University students	NR (age range majority 21-25, 47.45%)	Unspecified	Barriers, Factors associated
Annan et al., 2019	Ghana	Cross-sectional survey	200 Undergraduate students	20.4 (1.96)	Unspecified	Factors associated
Argaw et al., 2022	Ethiopia	Cross-sectional survey	385 Sex workers	29.3 (5.5)	Pap smear, VIA	Barriers, Factors associated
Aweke et al., 2017	Ethiopia	Cross-sectional survey	583 Childbearing women	NR (median 28)	VIA	Barriers, Factors associated
Ayeni et al., 2023	Nigeria	Cross-sectional survey	362 Women of reproductive age	25.19 (7.18)	Unspecified	Barriers
Ayinde et al., 2004	Nigeria	Cross-sectional survey	421 Undergraduate students	23.6 (3.6)	Pap smear	Barriers, Factors associated
Bakogianni et al., 2012	Greece	Cross-sectional survey	472 Students	21.3 (5.18)	Pap smear	Barriers
Bayu et al., 2016	Ethiopia	Cross-sectional survey	1 186 Women living in Mekelle Zone	31.3 (9.3)	VIA	Barriers, Factors associated
Bammeke & Chizoma, 2014	Nigeria	Cross-sectional survey	100 Women of reproductive age	NR (majority 26 - 30, 45%)	Unspecified	Barriers
Beer et al., 2014	UK	Secondary data analysis	30 882 Residents in Wales	NR (age range 22-24)	Unspecified	Factors associated
Bekele et al., 2022	Ethiopia	Cross-sectional survey	687 Female students	20.5 (3)	VIA	Facilitators, Factors associated
Binka et al., 2016	Ghana	Cross-sectional survey	410 Students	NR (age range majority 20-29, 61%)	Unspecified	Factors associated
Black et al., 2011	Canada	Qualitative focus groups	80 Attendants of university health clinics, shopping centres and community centres serving young women	NR (age range 20-29)	Pap smear	Barriers, Facilitators

Boone et al., 2016	USA	Retrospective matched-pair cohort study	2 246 HPV vaccinated and unvaccinated women	NR (age range 14-26)	Unspecified	Factors associated
Budd et al., 2014	Australia	Cross-sectional records review	NR: Young women	NR (age range 20-34)	Pap smear	Factors associated
Burak & Meyer, 1998	USA	Cross-sectional survey	400 Undergraduate students	19.1 (SD NR)	Pap smear	Barriers, Factors associated
Byrd et al., 2004	USA	Cross-sectional survey	189 Hispanic women	21 (SD NR; age range 18-25)	Pap smear	Factors associated
Changkun et al., 2022	India	Secondary data analysis	699 686 Women from the NFHS	NR (majority 15-29, 51.9%)	Unspecified	Factors associated
Chao et al., 2017	USA	Retrospective cohort study	27 352 KPSC members	NR (age range 25-30)	Pap smear	Factors associated
Cooper et al., 2018	Australia	Qualitative interviews	12 University students	21 (SD NR, age range 18-25)	Pap smear	Barriers, Facilitators
Deresse et al., 2018	Ethiopia	Cross-sectional survey	821 Women	26.07 (5.57)	Pap smear, VIA	Barriers
Dhendup & Tshering, 2014	Bhutan	Cross-sectional survey	559 Graduate students	23.43 (2.73)	Pap smear	Barriers, Factors associated
Dozie et al., 2021	Nigeria	Cross-sectional survey	375 Female undergraduates	NR (age range 16 – 29)	Pap smear, VILI, VIA	Barriers, Factors associated
Easwaran et al., 2023	Saudi Arabia	Cross-sectional survey	185 Pharmacy students	19.77 (6.71)	Unspecified	Barriers, Facilitators, Factors associated
Eiser & Cole, 2002	UK	Cross-sectional survey	70 Students	21.6 (1.14)	Pap smear	Barriers
Enyan et al., 2022	Ghana	Cross-sectional survey	431 Muslim women	30.9 (10.4)	Unspecified	Facilitators, Factors associated
Gebisa et al., 2022	Ethiopia	Cross-sectional survey	414 Women attending health facilities	NR (age range 18-49)	Unspecified	Barriers, Factors associated
Gebreegziabher et al., 2016	Ethiopia	Cross-sectional survey	225 Female nurses	NR (median 28)	Pap smear	Barriers, Factors associated

Gebregziabher et al., 2019	Ethiopia	Cross-sectional survey	344 Undergraduate students	23.67 (2.83)	Pap smear	Barriers, Factors associated
Gebru et al., 2016	Ethiopia	Cross-sectional survey	643 Married women	NR (majority 20-24, 27.1%)	Pap smear	Factors associated
Gelassa et al., 2023	Ethiopia	Cross-sectional survey	213 Women attending health faculties	32.2 (13.8)	Pap smear, VIA	Barriers, Factors associated
Getaneh et al., 2021	Ethiopia	Cross-sectional survey	403 Undergraduate students	21 (1.5)	Pap smear	Barriers
Guo et al., 2017	USA	Secondary data analysis	5 416 Respondents of NIHS survey	NR (age range 21-30)	Pap smear	Factors associated
Hauwa et al., 2021	Nigeria	Cross-sectional survey	230 Women	NR (majority 25-29, 30%)	Pap smear, VIA	Factors associated
Head & Cohen, 2012	USA	Qualitative focus groups & interviews	19 Women	NR (age range 20-26)	Pap smear	Barriers, Facilitators
Hirth et al., 2016	USA	Retrospective cohort study	24 964 Female health records	NR (age range 19-21)	Pap smear	Factors associated
Hoque et al., 2014	South Africa	Cross-sectional survey	440 University students	20.39 (1.71)	Pap smear	Factors associated
Ibekwe, 2015	Ethiopia	Comparative Cross-sectional survey	200 Clinical nursing students	DELSUTH 24.2 (2.6) & UBTH 23.2 (2.9)	Unspecified	Barriers
Ilika et al., 2016	Nigeria	Descriptive Cross-sectional survey	342 Undergraduate students	NR (majority 20-29, 97.7%)	Pap smear, HVS, ES, VIA	Barriers, Factors associated
Isabirye et al., 2022	Zimbabwe	Secondary data analysis	9 955 Women from the Zimbabwe Demographic 7 Health Survey	NR (age range 15-49)	VIA	Factors associated
Isara et al., 2013	Nigeria	Descriptive Cross-sectional survey	230 Medical students	20 (1.4)	Pap smear	Barriers, Factors associated
Jemal et al., 2023	Ethiopia	Mixed methods	241 Female health workers	Nr (age range majority </30, 72%)	Unspecified	Barriers, Factors associated

Jubelirer et al., 1996	USA	Cross-sectional survey	279 10th-grade students	NR (age range 14-18)	Pap smear	Barriers
Kabiri, 2021	Uganda	Cross-sectional survey	355 Female undergraduate students	NR (majority 21-25, 60.6%)	Pap smear, VIA	Barriers, Facilitators, Factors associated
Kahn et al., 1999	USA	Qualitative focus groups & interviews	27 Adolescents receiving care from a children's hospital	Focus group 17.6 (2.3); Interviews 18.7 (1.9)	Pap smear	Barriers
Kakubari et al., 2020	Japan	Cross-sectional survey	618 Residents of Japan	NR (age range 20-21)	Unspecified	Barriers, Factors associated
Kaneko, 2018	Japan	Cross-sectional survey	700 Unmarried Japanese females	26 (SD NR)	Pap smear	Factors associated
Karena & Payel, 2024	India	Cross-sectional survey	97 Female nursing staff	NR (age range 20-29)	Pap smear, VIA	Barriers, Facilitators
Kim et al., 2016	USA	Nested case-control study	10 204 Screened residences of Alberta	NR (age range 18-33)	Pap smear	Factors associated
Kitchener et al., 2018	UK	Cluster RCT	10 126 First screening invitation recipients	NR (age range 20-24.5)	Unspecified	Factors associated
Kreusch et al., 2018	Sweden	Cohort study	261 434 Residents of Sweden	NR (age range 24-27)	Unspecified	Factors associated
Langille & Rigby, 2006	Canada	Cross-sectional survey	1 090 female students	16.6 (0.1)	Unspecified	Factors associated
Lee & Lee, 2017	USA	Qualitative focus groups	16 Korean immigrant women	26 (SD NR, age range 21-29)	Pap smear	Barriers
Lee et al., 2015	USA	Cross-sectional survey	164 Hmong American immigrant women	30 (SD NR, age range majority 21-29, 59.8%)	Pap smear	Factors associated
Letuka & De Wet, 2018	Lesotho	Cross-sectional records review	1 542 Residents of Lesotho	NR (age range 15-19)	Pap smear	Factors associated
Mather et al., 2012	Australia	Cross-sectional survey	193 Psychology university students	Vacc 19.2 (2.05); Unvac 19.5 (2.10)	Pap smear	Factors associated
Miyoshi et al., 2021	Japan	Cross-sectional survey	435 Japanese members of an internet survey panel	NR (age range 18-19)	Unspecified	Factors associated

Moreira et al., 2006	Brazil	Cross-sectional survey	204 Women in waiting room of a gynaecological clinic	20 (2)	Pap smear	Barriers
Moudatsou et al., 2022	Greece	Cross-sectional survey	100 Female students	22.2 (2)	Pap smear	Barriers, Factors associated
Mpachika-Mfipa et al., 2023	Malawi	Cross-sectional survey	482 Women	NR (age range majority 18 – 24, 42.5%	VIA	Factors associated
Mpachika-Mfipa et al., 2022	Malawi	Cross-sectional survey	482 Women	NR (confirmed via author)	Unspecified	Factors associated
Najem et al., 1996	USA	Cross-sectional survey	3 343 Senior high school students	NR (age range 13-20)	Pap smear	Barriers, Factors associated
Natae et al., 2021	Ethiopia	Cross-sectional survey	392 Women	NR (majority 20-29, 58.2%)	VIA	Barriers, Factors associated
Ndikom & Ofi, 2012	Nigeria	Qualitative focus groups	82 Attenders of various health facilities	27.6 (4.5)	Pap smear	Barriers
Ngari et al., 2021	Kenya	Cross-sectional survey	80 Women	NR (age range 15–25)	Pap smear, VILI, VIA	Barriers
Ogbechie et al., 2012	USA	Cross-sectional survey	66 Visitors of Obstetrics and Gynaecology clinic	22.2 (1.9)	Pap smear	Factors associated
Ogbonna, 2017	UK	Cross-sectional survey	186 Sub-Saharan African students	NR (age range </18, majority 18-24, 56.5%)	Pap smear	Barriers
Osei et al., 2021	Ghana	Qualitative focus groups	35 Community women	NR (age range 19-60, majority 19-29, 71.4%)	Pap smear	Barriers, Facilitators
Oshima & Maezawa, 2013	Japan	Qualitative focus groups	15 Japanese university students	NR (age range 20-22)	Pap smear	Barriers
Owoeye & Ibrahim, 2013	Nigeria	Descriptive Cross-sectional survey	360 University staff and students	23.65 (5)	Pap smear, Liquid-based cytology & HPV DNA	Barriers, Facilitators, Factors associated

Park et al., 2023	South Korea	Secondary data analysis	17 730 married immigrant women	NR (age range 20-29)	Pap smear	Factors associated
Paynter et al., 2015	USA	Retrospective cohort study	2 308 Attenders of a medical centre	20.6 (0.09)	Unspecified	Factors associated
Pegu et al., 2020	India	Descriptive Cross-sectional survey	34 Nursing staff	25 (SD NR)	Pap smear	Barriers
Pengpid & Peltzer, 2014	Multicounty	Cross-sectional survey	9 194 Undergraduate students	20.9 (2)	Pap smear	Factors associated
Reiter & McRee, 2014	USA	Cross-sectional survey	418 Members of the LGBTQ community	23.8 (1.7)	Pap smear, HPV self-testing	Barriers, Factors associated
Rosita et al., 2023	India	Cross-sectional mixed methods	125 Female nurses	NR (majority 20 - 24, 76.8%)	Pap smear	Barriers, Facilitators
Sadler et al., 2013	UK	Qualitative focus groups	31 Women registered at a general practice	NR (age range 17-25)	Unspecified	Barriers, Facilitators
Sauer et al., 2015	USA	Cross-sectional records review	7 341 Young women	NR (age range 21-30)	Pap smear	Factors associated
Sauvageau et al., 2021	Canada	Cross-sectional survey	1 475 Young adults	NR (age range 17-29)	Pap smear	Factors associated
Seay et al., 2022	USA	Secondary data analysis	34 141 Active female US military service members	NR (majority 20-29, 79.4%)	Pap smear, HPV testing	Factors associated
Shand et al., 2010	Australia	Cross-sectional survey	274 Residents of Australia	21.75 (2.14)	Pap smear	Factors associated
Shin et al., 2022	Korea	Secondary data analysis	3,925 Korean women	NR (majority 20-29, 51%)	Pap smear	Factors associated
Shin et al., 2021	Korea	Mixed methods	26 Female university students	21.92 (1.26)	Pap smear	Barriers
Singh et al., 2022	India	Cross-sectional survey	100 Nursing staff	NR (majority 26-30, 48%)	Pap smear	Barriers
Singh et al., 2012	India	Descriptive cross-sectional survey	133 Nursing staff	27.82 (3.85)	Pap smear	Barriers, Factors associated

Tadesse et al., 2022	Ethiopia	Cross-sectional survey	667 Female students	NR (majority 15-20, 85.2%)	Pap smear, VIA	Barriers, Facilitators
Tang et al., 1999	USA	Cross-sectional survey	206 Undergraduate and graduate students	19 (20)	Pap smear	Barriers, Factors associated
Tay et al., 2015	Singapore	Cross-sectional survey	1 622 Staff nurses	NR (age range >/25, majority <30, 56.9%)	Unspecified	Barriers, Facilitators, Factors associated
Tesfaye et al., 2022	Ethiopia	Cross-sectional survey	393 Women hospital employees	NR (majority 25-29, 51.6%)	Unspecified	Barriers, Factors associated
Thapa et al., 2018	Nepal	Cross-sectional survey	360 Women	30.13 (10.4)	Pap smear, HPV test, VIA	Barriers, Factors associated
Ugonwanyi, 2014	Thailand	Cross-sectional survey	172 Female international students	24.4 (5.5)	VIA	Barriers, Factors associated
Wellensiek et al., 2002	South Africa	Cross-sectional survey	750 Attenders of a hospital, medical students, and student nurses	NR (majority </40, 60.6%, </30 46.41%)	Pap smear	Barriers, Factors associated
Yi, 1998	USA	Cross-sectional survey	207 Vietnamese university students	22.7 (3.4)	Pap smear	Factors associated
Yoo et al., 2011	USA	Cross-sectional survey	304 Korean American, Vietnamese American, and Filipino American women	20.82 (SD NR)	Pap smear	Factors associated
Zaidi et al., 2021	Pakistan	Cross-sectional survey	147 Undergraduate students	25 (0.62)	Pap smear	Barriers, Factors associated

NR = not reported EXP = Experimental group CON = Control group VILI = Visual Inspection with Lugol's Iodine VIA = Visual Inspection Method with Acetic Acid HVS = High Vaginal Swab ES = Endocervical Swab Vacc = HPV vaccinated Unvac = Not HPV vaccinated DELSUTH = Delta State University Teaching Hospital UBTH = University Benin Teaching Hospital KPSC = Kaiser Permanente Southern California NFHS = National Family Health Survey

2.3.3 Quality Assessment

The overall quality of the 106 studies was rated as medium, based on the MMAT quality score. Most studies reported clear aims and objectives and collected data that addressed the research aims. However, lower quality scores were observed for response rates, representativeness, and data collection in quantitative studies and for coherence, findings, and data collection in qualitative studies. Lack of clarity around qualitative methods of analysis used was the biggest issue among the qualitative studies and mixed-method studies (n = 3). Data analysis in quantitative studies that reported factors associated with screening predominantly utilised bivariate analysis (e.g. chi-square and binary logistic regression) and multivariate analysis (e.g. multiple logistic regression). However, factors adjusted for in multivariate analysis were not consistently reported in the included studies.

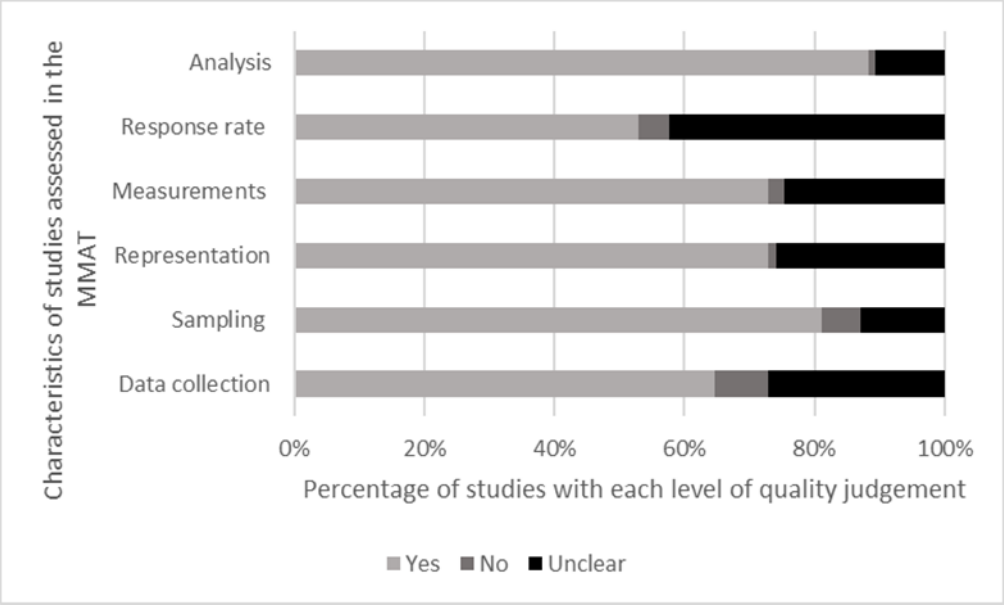

*Figure 2.2 Quality of descriptive quantitative studies (n = 85) *MMAT = Mixed methods appraisal tool*

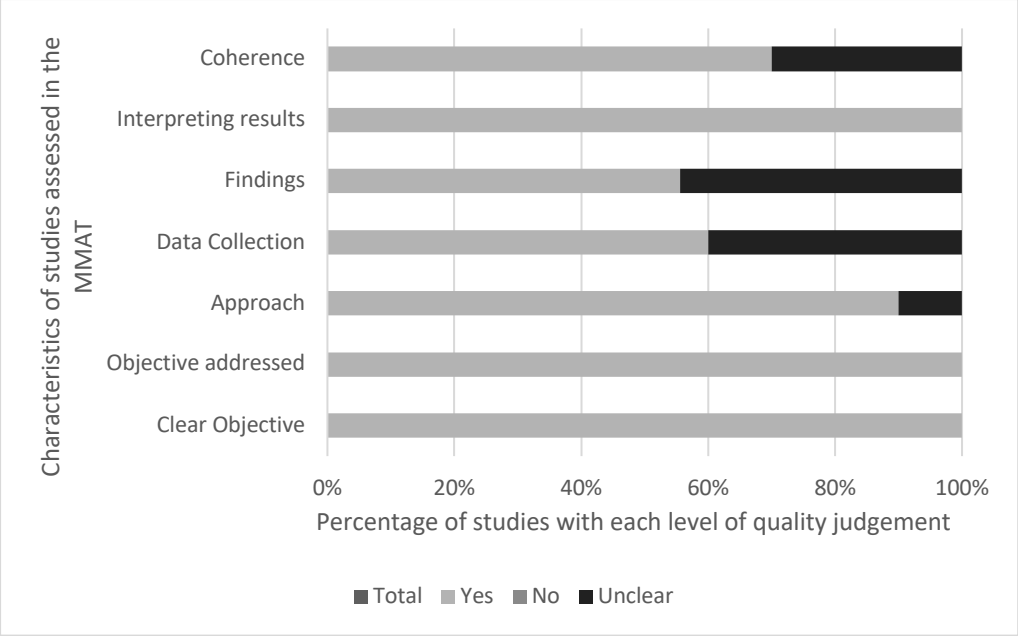

*Figure 2.3 Quality of qualitative studies (n = 10) *MMAT = Mixed methods appraisal tool*

Table 2.2 Summary of themes and sub-themes reported in the results

Theme	**Sub-theme**
Reported barriers to screening	Practical barriers
	Negative perceptions and feelings towards CC screening
	Knowledge and misinformation
	Cultural perceptions/biases
Reported facilitators of screening	
Factors associated with screening	Socio-demographic factors
	Vaccination status
	Psychological factors
	Knowledge
	Previous experience

2.3.4 Reported barriers to screening

Sixty-six of the 106 studies reported barriers to CC screening. Barriers were grouped into four overarching themes: practical barriers, negative perceptions and feelings towards CC screening, knowledge and misinformation, and cultural perceptions/biases (see Table 2.3 & Appendix B).

Table 2.3 Summary of main barriers cited in studies

Barrier theme	Specific barriers	N
Practical barriers		
	Financial constraints	36
	Accessibility constraints	34
	Time constraints	24
Perceptions of CCS		
	Embarrassment of procedure	35
	Fear of pain/discomfort	28
	Embarrassment/fear of result	24
	Lack of encouragement to attend	10
	Lack of trust in screening	9
	Afraid to visit a gynaecologist/doctor	5
Knowledge misinformation		
	Attitudes of fatalism	36
	Lack of knowledge	35
	Lack of interest	6
	Not sexually active	5
	Loss of virginity due to test	4
Cultural perceptions		
	Spouse/Familial constraints	12
	Fear of being seen or spoken about	6

2.3.4.1 Practical barriers

Several practical barriers were reported that directly impacted young women attending CC screening. Most notably, financial constraints were reported in 36 studies, including concerns over the cost of screening and it being "too expensive" (*n* = 35, Abiodun et al., 2014; Abotchie & Shokar, 2009; Akpo et al., 2016; Al-Naggar et al., 2010; Alwahaibi et al., 2017; Anikwe et al., 2021; Ayeni et al., 2023; Ayinde et al., 2004; Bakogianni et al., 2012; Bammeke, 2014; Bayu et al., 2016; Burak & Meyer, 1998; Cooper et al., 2018; Dozie et al., 2021; Gebisa et al., 2022; Gebreegziabher et al., 2016; Gelassa et al., 2023; Head & Cohen, 2012; Ibekwe, 2015; Ilika et al., 2016; Isara et al., 2013; Jubelirer et al., 1996; Kabiri, 2021; Kahn et al., 1999; Najem et al., 1996; Ndikom & Ofi, 2012; Ngari et al., 2013; Pegu et al., 2020; Reiter & McRee, 2014; Rosita et al., 2023; Tadesse et al., 2022; Thapa et al., 2018; Ugonwanyi, 2014; Zaidi et al., 2021) and lack of insurance cover (Ackerson et al., 2008), reported in Malaysia, Oman, Nigeria, Uganda, Kenya, Thailand, Pakistan, Greece, USA, Australia, Ghana, Nigeria, Ethiopia, Dominica, Nepal and India. Low accessibility to obtaining screening was also commonly reported (n = 34, Abiodun et al., 2014; Abotchie & Shokar, 2009; Ackerson et al., 2014; Akujobi et al., 2008; Al-Naggar et al., 2010; Alwahaibi et al., 2017; Aniebue et al., 2010; Aweke et al., 2017; Ayinde et al., 2004; Bammeke, 2014; Black et al., 2011; Cooper et al., 2018; Deresse et al., 2018; Dozie et al., 2021; Eiser & Cole, 2002; Gebreegziabher et al., 2016; Getaneh et al., 2021; Ibekwe, 2015; Ilika et al., 2016; Isara et al., 2013; Jemal et al., 2023; Jubelirer et al., 1996; Kabiri, 2021; Kahn et al., 1999; Kakubari et al., 2020; Lee & Lee, 2017; Moreira et al., 2006; Najem et al., 1996; Ndikom & Ofi, 2012; Ngari et al., 2017; Rosita et al., 2023; Sadler et al., 2013; Thapa et al., 2018), including participants not knowing where to get screening (*n* = 19, Abotchie & Shokar, 2009; Akujobi et al., 2008; Al-Naggar et al., 2010; Aniebue et al., 2010; Ayinde et al., 2004; Bammeke, 2014; Black et al., 2011; Cooper et al., 2018; Dozieet al., 2021; Gebreegziabher et

al., 2016; Getaneh et al., 2021; Ibekwe, 2015; Ilika et al., 2016; Isara et al., 2013; Jemal et al., 2021; Kakubari et al., 2020; Najem et al., 1996; Rosita et al., 2023), inconvenient locations (e.g. too far; *n* = 14, Abiodun et al., 2014; Alwahaibi et al., 2017; Aweke et al., 2017; Bammeke, 2014; Black et al., 2011; Deresse et al., 2018; Eiser & Cole, 2002; Gebreegziabher et al., 2016; Kabiri Grace, 2021; Kahn et al., 1999; Lee & Lee, 2017; Ndikom & Ofi, 2012; Ngari et al., 2021; Thapa et al., 2018) and difficulty getting an appointment (*n* = 12, Bammeke, 2014; Gebreegziabher et al., 2016; Ibekwe, 2015; Ilika et al., 2016; Isara et al., 2013; Jubelirer et al., 1996; Kabiri, 2021; Kahn et al., 1999; Moreira et al., 2006; Ogbonna, 2017; Rosita et al., 2023; Sadler et al., 2013). Other reported barriers included not knowing how to make the appointment (*n* = 5Ackerson et al., 2014; Deresse et al., 2018; Gebreegziabher et al., 2016; Kabiri, 2021; Najem et al., 1996), childcare constraints (*n* = 2, Black et al., 2011; Kahn et al., 1999) and moving home and not establishing a relationship with local care providers (*n* = 1, Black et al., 2011). Time constraints were cited in 24 studies, including being "too busy" and having "no time" (Akujobi et al., 2008; Alwahaibi et al., 2017; Anikwe et al., 2021; Argaw et al., 2022; Black et al., 2011; Cooper et al., 2018; Gebreegziabher et al., 2016; Getaneh et al., 2021; Jemal et al., 2023; Kabiri, 2021; Kahn et al., 1999; Najem et al., 1996; Ogbonna, 2017; Osei et al., 2021; Oshima & Maezawa, 2013; Sadler et al., 2013; Shin et al., 2021; Tay et al., 2015). Some studies also reported that participants noted no desire to dedicate time (Argaw et al., 2022; Gebregziabher et al., 2019; Kakubari et al., 2020; Moreira et al., 2006) and that screening was time-consuming (Ackerson et al., 2014; Bayu et al., 2016; Rosita et al., 2023).

2.3.4.2 Negative perceptions and feelings towards CC screening

Anxieties, fears, and embarrassment of the procedure were prominent among young women. In 35 studies, participants cited embarrassment of the procedure as a barrier to attending CC screening (Abotchie & Shokar, 2009; Akpo et al., 2016; Al-Naggar et al., 2010; Anikwe et al., 2021; Ayeni et al., 2023; Ayinde et al., 2004; Bayu et al., 2016; Black et al., 2011; Burak & Meyer, 1998; Easwaran et al., 2023; Gebisa et al., 2022; Gebreegziabher et al., 2023; Getaneh et al., 2021; Ibekwe, 2015; Ilika et al., 2016; Jemal et al., 2023; Jubelirer et al., 1996; Kahn et al., 1999; Kakubari et al., 2020; Moreira et al., 2006; Najem et al., 1996; Natae et al., 2021; Oshima & Maezawa, 2013; Owoeye & Ibrahim, 2013; Pegu et al., 2020; Reiter & McRee, 2014; Sadler et al., 2013; Singh et al., 2022; Singh et al., 2012; Tadesse et al., 2022; Tay et al., 2015; Thapa et al., 2018; Wellensiek et al., 2002). This was followed by fear of pain/discomfort (*n* = 28, Abotchie & Shokar, 2009; Akujobi et al., 2008; Al-Naggar et al., 2010; Alwahaibi et al., 2017; Bammeke, 2014; Bayu et al., 2016; Black et al., 2011; Burak & Meyer, 1998; Cooper et al., 2018; Deresse et al., 2018; Easwaran et al., 2023; Eiser & Cole, 2002; Gebisa et al., 2022; Gebreegziabher et al., 2016; Gebregziabher et al., 2019; Gelassa et al., 2023; Getaneh et al., 2021; Isara et al., 2013; Jemal et al., 2023; Jubelirer et al., 1996; Kabiri, 2021; Kahn et al., 1999; Moreira et al., 2006; Owoeye & Ibrahim, 2013; Pegu et al., 2020; Sadler et al., 2013; Tay et al., 2015; Ugonwanyi, 2014), feelings of vulnerability (*n* = 8, Alwahaibi et al., 2017; Cooper et al., 2018; Deresse et al., 2018; Head & Cohen, 2012; Kahn et al., 1999; Karena, 2024; Rosita et al., 2023; Ugonwanyi, 2014) and fear of the procedure (*n* = 4, Gelassa et al., 2023; Natae et al., 2021; Singh et al., 2022; Thapa et al., 2018).

Negative feelings regarding the result after screening were also cited in 24 studies. Young people's embarrassment and/or fear of a positive result (Akujobi et al., 2008; Alwahaibi et al., 2017; Anikwe et al., 2021; Argaw et al., 2022; Ayeni et al., 2023; Black et

al., 2011; Deresse et al., 2018; Dhendup & Tshering, 2014; Dozie et al., 2021; Gebisa et al., 2022; Gebreegziabher et al., 2016; Ibekwe, 2015; Ilika et al., 2016; Jemal et al., 2023; Jubelirer et al., 1996; Kabiri Grace, 2021; Kahn et al., 1999; Kakubari et al., 2020; Karena, 2024; Natae et al., 2021; Ndikom & Ofi, 2012; Rosita et al., 2023; Singh et al., 2012; Tesfaye et al., 2022), hesitancy to visit a gynaecologist or other healthcare services (*n* = 4, Bakogianni et al., 2012; Ilika et al., 2016; Kakubari et al., 2020; Oshima & Maezawa, 2013), and being generally worried about screening (*n* = 2, Abotchie & Shokar, 2009; Al-Naggar et al., 2010) were notable barriers.

Nine studies noted a lack of trust in screening as a barrier (Abotchie & Shokar, 2009; Alwahaibi et al., 2018; Ayinde et al., 2004; Dhendup & Tshering, 2014; Head & Cohen, 2012; Ilika et al., 2016; Kabiri, 2021; Kahn et al., 1999; Sadler et al., 2013), stating the test is not useful (*n* = 3, Alwahaibi et al., 2018; Ayinde et al., 2004; Ilika et al., 2016) and a lack of belief that the purpose is to diagnose cancer (Abotchie & Shokar, 2009). Previous negative experiences also were cited in reducing young people's trust in healthcare recommendations to attend screening (*n* = 4, Alwahaibi et al., 2018; Dhendup & Tshering, 2014; Kabiri, 2021; Sadler et al., 2013). Ten studies cited young people felt a lack of encouragement by healthcare workers, or in general, to attend screening (Al-Naggar et al., 2010; Bammeke, 2014; Deresse et al., 2018; Kabiri, 2021; Najem et al., 1996; Ndikom & Ofi, 2012; Oshima & Maezawa, 2013; Reiter & McRee, 2014; Rosita et al., 2023; Singh et al., 2022; Thapa et al., 2018).

2.3.4.3 Knowledge and Misinformation

A lack of awareness and knowledge surrounding all aspects of CC screening was cited in 35 studies across Africa, Europe, North America, Oceana and Asia (Abiodun et al., 2014; Ackerson et al., 2014; Akujobi et al., 2008; Alwahaibi et al., 2017; Anikwe et al., 2021;

Argaw et al., 2022; Aweke et al., 2017; Ayeni et al., 2023; Ayinde et al., 2004; Bammeke, 2014; Black et al., 2011; Deresse, 2018; Dhendup & Tshering, 2014; Dozie et al., 2021; Easwaran et al., 2023; Gebisa et al., 2022; Gelassa et al., 2023; Getaneh et al., 2021; Ilika et al., 2016; Kahn et al., 1999; Kakubari et al., 2020; Lee & Lee, 2017; Najem et al., 1996; Natae et al., 2021; Ndikom & Ofi, 2012; Ngari et al., 2021; Osei et al., 2021; Rosita et al., 2023; Sadler et al., 2013; Shin et al., 2021; Tadesse et al., 2022; Thapa et al., 2018; Ugonwanyi, 2014; Wellensiek et al., 2002; Zaidi et al., 2021). Nine of these studies based in African countries and Oman reported that young people had never heard of Pap smear/screening (Akujobi et al., 2008; N. Alwahaibi et al., 2018; Anikwe et al., 2021; Argaw et al., 2022; Aweke et al., 2017; Deresse et al., 2018; Dhendup & Tshering, 2014; Getaneh et al., 2021; Wellensiek et al., 2002) and another two studies from Japan and Ethiopia reported individuals never having heard of CC (Aweke et al., 2017; Kakubari et al., 2020). Misinformation regarding being HPV vaccinated and no longer needing screening was cited once (Bakogianni et al., 2012) and four papers from Greece, UK, Uganda and Japan cited young age as an inhibiting factor, with views that screening should be done at a later age (Alwahaibi et al., 2017; Kabiri, 2021; Kakubari et al., 2020; Sadler et al., 2013).

Five studies reported that not being sexually active was a reason for not being screening (Anikwe et al., 2021; Kakubari et al., 2020; Moudatsou et al., 2022; Osei et al., 2021; Tay et al., 2015), as well as concerns of “loss of virginity” due to the nature of screening, reported in three studies from Malaysia, Ghana, Pakistan and India (Abotchie & Shokar, 2009; Al-Naggar et al., 2010; Getaneh et al., 2021; Zaidi et al., 2021).

Notably, attitudes of fatalism regarding young people's overall health were reported in 36 studies. A lack of symptoms was cited 24 times (Ackerson et al., 2008; Akpo et al., 2016; Alwahaibi et al., 2017; Aniebue et al., 2010; Argaw et al., 2022; Aweke et al., 2017; Ayeni et

al., 2023; Bayu et al., 2016; Dozie et al., 2021; Easwaran et al., 2023; Gebisa et al., 2022; Gelassa et al., 2023; Getaneh et al., 2021; Jemal et al., 2023; Kakubari et al., 2020; Karena & Payal, 2024; Natae et al., 2013; Reiter & McRee, 2014; Singh et al., 2022; Singh et al., 2012; Tadesse et al., 2022; Thapa et al., 2018; Ugonwanyi, 2014) whereas, 11 studies also reported that participants did not believe that cancer affected them (Ayinde et al., 2004; Bammeke, 2014; Gebreegziabher et al., 2016; Kabiri, 2021; Kahn et al., 1999; Kakubari et al., 2020; Karena & Payal, 2024; Najem et al., 1996; Sadler et al., 2013; Singh et al., 2022; Singh et al., 2012). Five studies reported an overall lack of interest in screening (Abiodun et al., 2014; Ackerson et al., 2014; Anikwe et al., 2021; Getaneh et al., 2021; Ngari et al., 2021; Rosita et al., 2023). Four studies reported screening as simply not necessary with no further explanation (Akujobi et al., 2008; Isara et al., 2013; Moudatsou et al., 2022; Tay et al., 2015).

2.3.4.4 Cultural perceptions/biases

Cultural biases and/or prejudices against screening were reported in four studies (Deresse et al., 2018; Lee & Lee, 2017; Ngari et al., 2021; Tang et al., 1999). However, multiple studies reported specific cultural reasons for not attending screening. Fear of being seen or spoken about was reported in six studies from Nigeria, Uganda, Japan, and USA. This included reports of worrying what others might say (Abotchie & Shokar, 2009; Oshima & Maezawa, 2013; Shin et al., 2021), being afraid of being seen visiting the gynaecologist (Oshima & Maezawa, 2013), and fear of parents finding out about sexual behaviour (Head & Cohen, 2012; Jubelirer et al., 1996; Kahn et al., 1999; Shin, 2021). Spousal and familial roles as barriers to screening were also reported. In eight studies from Malaysia (Al-Naggar et al., 2010), Ethiopia (Deresse et al., 2018; Gebisa et al., 2022; Gebreegziabher et al., 2016; Gelassa et al., 2023; Getaneh et al., 2021), India (Rosita et al., 2023) and Ghana (Abotchie & Shokar, 2009) young women reported a spouse not allowing attendance to screening as a barrier.

2.3.5 Reported facilitators of screening

Table 2.4 Summary of main facilitators cited in studies

Facilitator	N
Knowledge and beliefs	12
Healthcare recommendations and/or reminders	11
Communication with friends and family	11
Opportunistic	8

Eighteen studies included reports of facilitators of CC screening (see Table 2.4 & Appendix C). Increased knowledge of and belief in CC screening were the most commonly reported facilitators in 12 studies (Ackerson et al., 2008; Alwahaibi et al., 2017; Bekele et al., 2022; Cooper et al., 2018; Enyan et al., 2022; Kabiri, 2021; Karena & Payal, 2024; Osei et al., 2021; Owoeye & Ibrahim, 2013; Rosita et al., 2023; Tadesse et al., 2022; Tay et al., 2015). Specific points included the belief that screening reduces risk (Ackerson et al., 2008; Kabiri, 2021; Tay et al., 2015), general awareness (Kabiri, 2021; Karena & Payal, 2024; Osei et al., 2021), understanding the importance of screening (Alwahaibi et al., 2017; Kabiri, 2021) and the long-term benefit of screening (Cooper et al., 2018; Kabiri, 2021).

Healthcare provider recommendations and reminders were also commonly reported facilitators (Alwahaibi et al., 2017; Anaman et al., 2016; Aniebue et al., 2010; Bekele et al., 2022; Black et al., 2011; Enyan et al., 2022; Owoeye & Ibrahim, 2013; Rosita et al., 2023; Sadler et al., 2013; Tadesse et al., 2022; Tay et al., 2015). Five studies based in Ghana (Osei et al., 2021), Oman (Alwahaibi et al., 2017), Nigeria (Owoeye & Ibrahim, 2013), Uganda (Kabiri, 2021) and India (Rosita et al., 2023) cited the financial facilitator of CC screening

being cost-free, whether in general, at work or during a CC screening awareness month incentive (Osei et al., 2021). One study also cited being able to afford screening as a facilitator of attendance (Kabiri, 2021).

Mention of opportunistic reasoning for attending was reported in eight studies (Alwahaibi et al., 2017; Black et al., 2011; Easwaranet al., 2023; Enyan et al., 2022; Kabiri, 2021; Karena & Payal, 2024; Owoeye & Ibrahim, 2013; Rosita et al., 2023); including, during pregnancy (Black et al., 2011), renewal of oral contraceptives (Black et al., 2011), when combined with other tests (Karena & Payal, 2024; Owoeye & Ibrahim, 2013), having enough time during that period (Alwahaibi et al., 2017) and having a convenient location (Enyan et al., 2022).

Communication with friends and family was reported in eleven studies. Specifically, friends' encouragement and open conversation around the procedure and topic were recognized as a facilitator in seven studies (Ackerson et al., 2008; Alwahaibi et al., 2017; Bekele et al., 2022; Cooper et al., 2018; Kabiri, 2021; Tadesse et al., 2022; Tay et al., 2015). Similarly, maternal involvement in promoting CC screening and as a source of information was noted in three studies (Ackerson et al., 2008; Anaman et al., 2016; Cooper et al., 2018; Head & Cohen, 2012).

2.3.6 Factors associated with screening

Seventy-four studies analysed factors associated with CC screening. These were grouped into four overarching themes: Socio-demographic factors, vaccination status, psychological factors, knowledge and previous experiences (See Appendix D and E).

2.3.6.1 Socio-demographic factors

2.3.6.1.1 Age

Thirty-one studies examined the relationship between age and screening. The majority of the 20 significant relationships indicated an increase in screening attendance with older age (Alwahaibi et al., 2018; Bayu et al., 2016; Changkun et al., 2022; Dhendup & Tshering, 2014; Dozie et al., 2021; Gebregziabher et al., 2019; Gebru et al., 2016; Hirth et al., 2016; Isabirye et al., 2022; Kaneko, 2018; Langille & Rigby, 2006; Mpachika-Mfipa et al, 2022; Najem et al., 1996; Natae et al., 2021; Reiter & McRee, 2014; Yoo et al., 2011), although some studies reported declining attendance with older age (Argaw et al., 2022; Seay et al., 2022; Tay et al., 2015; Tesfaye et al., 2022). Although findings were mostly consistent, it is important to consider the varying quality of studies, as only two studies scored high in quality (Argaw et al., 2022; Natae et al., 2021).

2.3.6.1.2 Marital status

Of the 28 studies that examined marital status, all significant findings reported increased odds of screening in those married or in a relationship when compared to those who are single (Ackerson et al., 2014; Alwahaibi et al., 2018; Alwahaibi et al., 2017; Anaman et al., 2016; Aniebue et al., 2010; Anikwe et al., 2021; Ayinde et al., 2004; Dhendup & Tshering, 2014; Dozie et al., 2021; Gebregziabher et al., 2019; Kabiri, 2021; Lee et al., 2015; Letuka & De Wet, 2018; Pengpid & Peltzer, 2014; Reiter & McRee, 2014; Shand et al., 2010; Singh et al., 2012; Yi, 1998). The quality of these studies was broadly consistent as medium quality, although three studies scored lower quality in sampling (Shand et al., 2010), representation (Gebregziabher et al., 2019) and response rate (Ackerson et al., 2014). Only one study scored high in quality (Singh et al., 2012).

2.3.6.1.3 Employment status

Fourteen studies examined employment status and eight reported significant results. Five reported that those working were more likely to attend screening than those unemployed or of housewife status (Anaman et al., 2016; Changkun et al., 2022; Isabirye et al., 2022; Kaneko, 2018; Shin et al., 2022) and were 5.9 times more likely to attend screening when working compared with being at school (Binka et al., 2016). Healthcare professionals had higher odds of screening when compared to those in the Air Force (Seay et al., 2022) and cleaners (Tesfaye et al., 2022), as well as those working in outpatient wards compared to other wards in a hospital (Gebreegziabher et al., 2016). Overall quality of these studies was consistent but moderate.

2.3.6.1.4 Education

Sixteen studies of variable quality examined the effect of level of education and found consistent results. The majority reported increased odds in screening with increased education or years in college (Alwahaibi et al., 2017; Bekele et al., 2022; Dozie et al., 2021; Enyan et al., 2022; Gebregziabher et al., 2019; Gelassa et al., 2023; Hauwa et al., 2021; Isabirye et al., 2022; Jemal et al., 2023; Kabiri, 2021; Tang et al., 1999; Wellensiek et al., 2002), with only a few studies reporting equivocal (Ayinde et al., 2004; Moudatsou et al., 2022; Thapa et al., 2018) or negative results (Letuka & De Wet, 2018).

2.3.6.1.5 Ethnicity

Ten studies of variable quality examined ethnicity with six reporting mixed significant results (Mpachika-Mfipa et al., 2022; Najem et al., 1996; Paynter et al., 2015; Reiter & McRee, 2014; Tang et al., 1999; Thapa et al., 2018; Yoo et al., 2011).

2.3.6.1.6 Residence

Six of nine studies that reported place of residence found this to be a significant factor. Those living in urban areas (Changkun et al., 2022; Letuka & De Wet, 2018; Mpachika-Mfipa et al., 2022; Park et al., 2023) or major towns (Langille & Rigby, 2006) were more likely to attend screening when compared to those living in rural areas. One study explored differences among specific regions of Zimbabwe (Isabirye et al., 2022). Quality scores were moderate across these studies, and findings were consistent.

2.3.6.1.7 Sexual activity

Thirteen studies examined sexual activity. Six studies measured this using age at first sexual activity (Bayu et al., 2016; Isabirye et al., 2022; Kabiri, 2021; Letuka & De Wet, 2018; Reiter & McRee, 2014; Wellensiek et al., 2002) and seven reported on whether the women were sexually active or not (Aniebue et al., 2010; Ayinde et al., 2004; Gebregziabher et al., 2019; Kabiri, 2021; Pengpid & Peltzer, 2014; Shand et al., 2010; Yi, 1998). Almost all significant associations, excluding one (Aniebue et al., 2010), reported a positive association with being sexually active and attending screening (Ayinde et al., 2004; Gebregziabher et al., 2019; Kabiri, 2021; Pengpid & Peltzer, 2014; Shand et al., 2010; Yi, 1998). One study also reported that the use of a hormonal contraceptive increased the odds of screening compared to those using condoms only or an ineffective method (Langille & Rigby, 2006).

Seven of ten studies reported significant results regarding lifetime sexual partners, indicating pap testing is more common amongst those with more sexual partners compared to those with none (Bayu et al., 2016; Jemal et al., 2021; Kaneko, 2018; Pengpid & Peltzer, 2014; Reiter & McRee, 2014; Tesfaye et al., 2022). Findings were mostly consistent across studies with moderate scores in quality.

One study reported on sexual orientation, indicating an increased prevalence of screening amongst those who identify as bisexual compared to those who identify as lesbian (Reiter & McRee, 2014).

2.3.6.2 Vaccination status

Eleven of 13 studies examining HPV vaccination status reported a significant positive association with being vaccinated (Beer et al., 2014; Boone et al., 2016; Chao et al., 2017; Guo et al., 2017; Kakubari et al., 2020; Kaneko, 2018; Kitchener et al., 2018; Kreusch et al., 2018; Miyoshi et al., 2021; Reiter & McRee, 2014; Sauer et al., 2015). When adjusting for age differences in participants, six out of seven studies also found a similar association (Boone et al., 2016; Budd et al., 2014; Guo et al., 2017; Hirth et al., 2016; Kim et al., 2016; Sauer et al., 2015). When also adjusting for race, three studies reported that vaccination still increased the odds of being screened (Chao et al., 2017; Guo et al., 2017; Sauer et al., 2015). Evidence and quality of studies reporting vaccination were consistent and moderate, although one study scored low in sampling (Kaneko, 2018).

2.3.6.3 Psychological factors

Five out of six studies reported greater perceived benefits and/or prevention orientation was significantly positively associated with screening uptake(Ackerson et al., 2014; Burak & Meyer, 1998; Hoque et al., 2014; Pengpid & Peltzer, 2014; Tang et al., 1999).

Five of six studies examining perceived logistical barriers to screening reported that those who had received screening perceived fewer logistical barriers than those who had not (Ackerson et al., 2014; Bayu et al., 2016; Byrd et al., 2004; Hoque et al., 2014; Kaneko,

2018). Likewise, one study also reported that students who had been screened scored higher in self-efficacy than those who had not been screened (Hoque et al., 2014). Evidence and quality of studies on perceived benefits and logistical barriers were moderate and consistent.

Eleven studies examined the perceived susceptibility of CC and screening (Ackerson et al., 2014; Anaman et al., 2016; Annan et al., 2019; Bayu et al., 2016; Burak & Meyer, 1998; Gebruet al., 2016; Hoque et al., 2014; Kaneko, 2018; Reiter & McRee, 2014; Tay et al., 2015; Ugonwanyi, 2014). Only five studies found that greater perceived susceptibility was significantly associated with uptake of screening (Anaman et al., 2016; Bayu et al., 2016; Kaneko, 2018; Ugonwanyi, 2014), even when comparing LGBTQ+ individuals with heterosexual individuals(Reiter & McRee, 2014).

Five studies reported on the perceived severity of CC (Anaman et al., 2016; Annan et al., 2019; Bayu et al., 2016; Burak & Meyer, 1998; Byrd et al., 2004) and two studies reported that increased perceived seriousness of CC alone (Annan et al., 2019) or more than other cancers (Byrd et al., 2004) was significantly associated with increased screening attendance. However, given the small number of significant findings in relation to perceived severity and susceptibility, it is difficult to draw a strong conclusion.

2.3.6.4 Knowledge

Twenty-four studies examined knowledge of CC and pap smear and screening. Sixteen studies reported significant positive associations between knowledge and attending screening (Alwahaibi et al., 2018; Anaman et al., 2016; Annan et al., 2019; Argaw et al., 2022; Aweke et al., 2017; Bayu et al., 2016; Bekele et al., 2022; Dhendup & Tshering, 2014; Enyan et al., 2022; Gelassa et al., 2023; Jemal et al., 2023; Mpachika-Mfipa et al., 2023; Najem et al., 1996; Natae et al., 2021; Tesfaye et al., 2022; Zaidi et al., 2021). One study also reported that increased knowledge of HPV was associated with screening uptake (Reiter & McRee,

2014). The quality and findings of these studies were mostly consistent, including five high-scoring quality papers (Argaw et al., 2022; Enyan et al., 2022; Gelassa et al., 2023; Natae et al., 2021; Tesfaye et al., 2022).

2.3.6.5 Previous experiences

Five studies reported significant positive associations between screening and having had a routine check-up and/or visited a gynaecologist (Anaman et al., 2016; Natae et al., 2021; Reiter & McRee, 2014; Tang et al., 1999; Tay et al., 2015).

Two studies reported that a previous invitation to screening was positively associated with attending screening compared to those who had not received an invitation (Dhendup & Tshering, 2014; Najem et al., 1996). A family member's previous screening was also positively associated with screening (Najem et al., 1996).

Three studies examined having a usual source of care (Anaman et al., 2016; Tang et al., 1999; Yi, 1998), although only one found that having a regular place for care was positively associated with screening (Yi, 1998). Although findings were consistent for these factors, it is difficult to draw a strong conclusion based on the small number of findings.

2.4 Discussion

2.4.1 Main Findings

Reported barriers to screening were grouped into four main sub-themes: practical barriers, negative perceptions and feelings towards CC screening, knowledge/misinformation, and cultural perceptions/biases. Reported facilitators included healthcare provider recommendations, communication with friends and family and knowledge of CC screening. Factors associated with screening fell into four main areas: socio-demographic factors, vaccination status, psychological factors, and previous experiences.

Some themes were prevalent across different countries and areas of the world. For example, accessibility and time constraints appeared throughout, along with more specific concerns over the location (Abiodun et al., 2014; Alwahaibi et al., 2017; Aweke et al., 2017; Black et al., 2011; Deresse et al., 2018; Eiser & Cole, 2002; Gebreegziabher et al., 2016; Kahn et al., 1999; Lee & Lee, 2017; Ndikom & Ofi, 2012; Thapa et al., 2018) and difficulty getting an appointment (Gebreegziabher et al., 2016; Ibekwe, 2015; Ilika et al., 2016; Isara et al., 2013; Jubelirer et al., 1996; Kahn et al., 1999; Moreira et al., 2006; Ogbonna, 2017; Rosita et al., 2023; Sadler et al., 2013). Financial constraints were the most prominent barrier in countries or regions where free screening programmes were not available. However, a study based in Greece, where a free screening programme is available, also cited cost as a barrier, indicating that there could be other financial cost constraints aside from paying for screening (e.g., transport) (Bakogianni et al., 2012). Such barriers may be particularly important for younger women who must juggle work and childcare and may not be as financially stable as their older counterparts. Interventions could therefore target improving accessibility by creating opportunities for screening in convenient locations and times, such as drop-in clinics (O'Donovan et al., 2021). Contrary to previous reviews (Kirubarajan et al.,

2021; Limmer et al., 2014) that suggested an impact of socioeconomic status on screening, studies included in the current review did not frequently test for the association between socioeconomic status and screening, nor report there being a strong association.

Cultural barriers and concerns surrounding loss of virginity and sex-negative beliefs were not prominent, but fears of being seen or spoken about remained a concern across different countries (Abotchie & Shokar, 2009; Jubelirer et al., 1996; Oshima & Maezawa, 2013). Additionally, lack of encouragement or communication about CC screening from social circles and health professionals which were often reported by participants likely further enhances these negative perceptions. Furthermore, a previous review found moderate strength of evidence that telephone support increased screening uptake in ethnic minorities (Glick et al., 2012). It is perhaps unsurprising that one of the main reported facilitators among young people was the importance of open communication about screening with friends and family and recommendations from health care providers.

Psychological barriers were far more prevalent in the current review in comparison to a previous review (Kirubarajan et al., 2021). Feelings of fear and embarrassment surrounding multiple aspects of the screening procedure and fear of the results were the most often reported barriers for young women. The prevalence of fear as a barrier to screening was also highlighted in a previous review of studies based in Sub-Saharan Africa (Lim & Ojo, 2017). However, only 14 studies statistically tested the relationship between at least one psychological factor and screening uptake (Abotchie & Shokar, 2009; Ackerson et al., 2014; Ackerson et al., 2008; Burak & Meyer, 1998; Byrd et al., 2004; Enyan et al., 2022; Head & Cohen, 2012; Hoque et al., 2014; Kahn et al., 1999; Lee et al., 2015; Ndikom & Ofi, 2012). Moreover, it is interesting to note that only 11 papers utilised a theoretical framework, with the Health Belief Model (HBM) being the most popular (Abotchie & Shokar, 2009; Burak &

Meyer, 1998; Byrd et al., 2004; Enyan et al., 2022; Hoque et al., 2014; Kahn et al., 1999; Ndikom & Ofi, 2012). The HBM is a health behaviour change model developed to explain and predict health-related behaviours, with a focus on uptake in health services. HBM constructs focus on an individual's perceptions of the health threat (i.e., perceived susceptibility, perceived severity) and the health actions can prevent it (i.e., perceived benefits, perceived barriers) (Rosenstock, 1974). Perceived susceptibility, benefits and logistical barriers were most frequently analysed and consistently associated with screening uptake.

A lack of awareness and knowledge surrounding CC and screening was consistently reported as a barrier for young women across countries. This was supported by studies highlighting the positive impact of increased knowledge on screening attendance, and the fact that it was a common self-reported facilitator for those who had attended. Given that CC screening is likely the first invitation or experience of a pelvic exam, it is vital that young people are equipped with a basic knowledge and understanding of the purpose of CC screening.

Reported demographic factors associated with screening highlighted that being in a relationship or married, being older, being sexually active or being vaccinated, were significantly associated with screening attendance. Multiple reasons could explain why those vaccinated are attending screening more than those unvaccinated. Despite screening rates declining over the past decade (GOV.UK, 2022), the evidence does not suggest that this is likely due to the introduction and success of the HPV vaccination programme. The suggestion that vaccination could result in a perceived false sense of protection against CC has also not been supported by the current literature (Kulasingam et al., 2007). Instead, positive protective health behaviour (e.g., vaccination) could promote participation in future

health screenings (Benzies et al., 2008; Hajat et al., 2019) or alleviate anxieties around screening outcomes; another common barrier to screening.

2.4.2 Strengths and Limitations

This is the first systematic review of barriers, facilitators and factors associated with CC screening for women under 30. Although a previous review has examined reported barriers and facilitators (Kirubarajan et al., 2021), this is the first review to also examine factors associated with screening. Moreover, the current review extended the inclusiveness of the original review by including 106 studies across low-, middle- and high-income countries. Title and abstract screening were specifically more inclusive and did not exclude potential studies at this stage, for example due to the lack of mention of the age profile of the sample. A more conservative stance was taken at full-text screening where studies were only included if they explicitly reported personal barriers and facilitators to CC screening in young women aged 25-30. As a result, the current review included 92 studies not included previously and only 14 out of 36 studies from a previous review (Kirubarajan et al., 2021) were included. Alongside these factors, the current review also implemented a stricter age limit of under 30 compared to under 35 (Kirubarajan et al., 2021). This allowed for more focused findings for young women and first-time attendees.

The present review also has some limitations. Most included studies were closed-ended cross-sectional surveys. Therefore, the factors highlighted may simply reflect the researcher's preference and choice of inclusion when designing the surveys. Furthermore, reporting was not always consistent. Barriers and facilitators were often reported without statistical data or weighting, therefore making it difficult to determine the importance or relevance of a factor to the study population. As a result, the current review highlighted the number of times a

barrier or facilitator was reported across studies but was unable to determine importance beyond this. Grey literature and unpublished studies were not included in this review and were limited to searching publicly accessible databases only. However, given the size of the review, this is unlikely to have changed the main findings.

2.4.3 Implications for research and practice

Further research could utilise the key factors associated with screening in young women for targeted interventions to increase and maintain screening uptake. Evidence of an association with vaccination status and screening is highly relevant to the current population. The current review identified that vaccinated women were more likely to attend screening than those who were not vaccinated; however, as the numbers of those vaccinated continue to become more widely available, the impact of vaccination status on CC screening will become more apparent. On an international level, this would be the case for all 27 countries that have introduced HPV vaccination programmes in the last 15 years (Gavi, 2022). Given that unvaccinated women are less likely to attend screening, vaccination could be further utilised as a facilitator. Therefore, policies and interventions could benefit from promoting HPV vaccination as well as CC screening.

Future research would benefit from utilising a strong theoretical framework, such as the COM-B model of behavioural change (Michie et al., 2011), to categorise and provide further clarity on contributing factors to screening. The COM-B model of behavioural change is designed to provide an overarching framework that captures all factors that influence behaviour change (Michie et al., 2011). The COM-B states that for the behaviour to take place, an individual must 1) have the physical and psychological capability to perform the behaviour; 2) have the physical and social opportunity to do so; and 3) have reflective

(conscious thought and decision-making) and automatic (habits and subconscious processes) motivation (Michie et al., 2011). Some previous work has utilised the COM-B model when analysing screening behaviours and barriers amongst different age groups (Alam et al., 2021; O'Donovan et al., 2021). In the current review, reported barriers aligned predominantly with psychological capabilities (e.g., knowledge) and physical opportunity components (e.g., accessibility). The most frequently reported facilitators related to social opportunity (e.g., open communication) and psychological capabilities (e.g., knowledge). Interestingly, factors reflecting psychological capabilities were not prominent in studies that analysed factors associated with screening. Instead, reflective motivational components such as perceived benefits and perceived susceptibility were investigated in some studies and found to be associated with screening attendance, even though they were not frequently reported barriers and facilitators in the included studies.

The lack of attention on psychological factors in studies testing factors associated with screening in young women is surprising given the frequency of these factors as reported barriers. Emotional factors of embarrassment and fear of pain are often reported when discussing screening. When considering external influences that could further contribute to these feelings, healthcare providers should be trained and knowledgeable in in-patient communication to help ease these concerns before, during and after the screening process. Moreover, as negative experiences with CC screening would be limited at this age, compared to older individuals (Marlow et al., 2019), the importance of a positive first experience is crucial to ensure that this acts as a facilitator for future attendance. Recommendations from healthcare providers were also one of the most reported facilitators of screening. Healthcare providers can play an active role in the decision to screen but also act as facilitators during screening.

Only one study looked at screening in the LGBTQ+ community and the unique barriers that may impact their screening attendance (Reiter & McRee, 2014). In alignment with an earlier review (Kirubarajan et al., 2021), perceptions and screening behaviours of this group are underrepresented in research. Similarly, only two studies from the USA focused on non-native women of this age group. Given the growing number of multicultural populations, particularly in the West, cultural factors must be understood and acknowledged when promoting screening in this age group. Given the importance of communication amongst friends and family as a facilitator to screening, it is important to be aware of differences in taboos and understandings around CC and CC screening.

2.5 Conclusion

The current systematic review highlights several potential factors impacting screening uptake in young women, including common barriers of embarrassment, low accessibility, and financial constraints, as well as common facilitators such as knowledge, communication, and health provider recommendations. In addition, age, marital status, sexual activity, and HPV vaccination were shown to be significantly associated with screening uptake. Future research could benefit from adopting stronger theoretical frameworks to categorise and provide further insight into contributing factors affecting screening attendance.

2.5.1 Implication for thesis

Findings from this systematic review provided a foundation for the thesis. Currently reported barriers, facilitators and factors associated with cervical screening attendance not only provided a global perspective of the current literature and factors influencing screening behaviours but also highlighted limitations of current literature. As previously mentioned, the

systematic review highlighted an overall lack of theoretical application in study design and analysis. Furthermore, varied reporting methods meant that both qualitative and quantitative methodologies were not reported, often not including details such as researchers' philosophical stances for qualitative analysis and key details regarding survey development in cross-sectional survey studies. As such, these limitations were considered when designing and carrying out the following studies in this thesis.

Chapter 3 Utilising the COM-B Model to Interpret Barriers and Facilitators to Cervical Screening in Young Women

3.1 Introduction

Cervical cancer remains a public health concern worldwide and in the United Kingdom (UK), despite the availability of free effective preventative measures such as cervical screening under the National Health Service (NHS, 2023). According to the European age-standardised incidence rate, cancer rates in the UK have increased by 13% in young females over the last decade (Cancer Research UK, 2022). Furthermore, epidemiological studies have revealed the highest prevalence of cervical cancer cases in situ, preinvasive lesions that without treatment may develop into invasive carcinoma, is in females aged 25-29 (Cancer Research UK, 2019). Therefore, cervical screening programmes remain central to early diagnosis, with 99.8% of cervical cancer cases being preventable (Roope, 2021).

However, there is a clear age gradient in cervical screening uptake in the UK with younger women (59.7% of 25-29-year-olds) being less likely to attend than older women (72.1% of 45-49-year-olds) (NHS Digital, 2021). One reason for this may be that young women tend to report more practical barriers to screening attendance and lower perceptions of risk for developing cancer (Waller *et al.*, 2009). Therefore, it is important to understand the unique perspectives and barriers to screening in this age group. A recent systematic review highlighted the utility of the COM-B model in conceptualising barriers and facilitators reported in previous studies of the uptake of cervical screening in young women (Shpendi *et al.*, 2024). The COM-B model is designed to provide an overarching framework that captures

all factors that influence behaviour change (Michie, van Stralen and West, 2011). The COM-B model states that behaviour is the outcome of 1) physical and psychological *capability* to perform the behaviour; 2) physical and social *opportunity* to do so; and 3) reflective (conscious thought and decision-making) and automatic (habits and subconscious processes) *motivation* (Michie, van Stralen and West, 2011). The COM-B model has previously been used to examine cervical screening behaviours as well as to illustrate barriers to attendance among different age groups (Alam *et al.*, 2021; O'Donovan *et al.*, 2021). Shpendi *et al.* (2024) reported that key barriers to attending cervical screening identified among those aged 30 and younger aligned with the physical opportunity (e.g., low accessibility and financial constraints) and automatic motivation (e.g., embarrassment) components of the COM-B model. In contrast, psychological capability (e.g., knowledge) and social opportunity (e.g., communication with friends and family) were commonly cited factors facilitating screening attendance.

It is important to note that the majority of women in the UK who now reach the screening age (24.5 years old) will have received the Human Papillomavirus (HPV) vaccination (UK Health Security Agency, 2022). Persistent HPV infection remains one of the most common causes of cervical cancer (Bedell *et al.*, 2020), therefore, it follows that a reduction in HPV infection via vaccination would reduce the prevalence of cervical cancer. This means that vaccination could potentially influence cervical screening uptake both positively and negatively. On the one hand, it might be that lower attendance could result from a reduced perceived need for cervical screening among the vaccinated. Alternatively, vaccination could serve to alleviate anxieties or provide reassurance surrounding the likelihood of receiving positive screening results and therefore increase attendance. Indeed, previous studies have reported that HPV vaccination is positively related to the uptake of cervical screening (Beer *et al.*, 2014; Boone *et al.*, 2016; Kitchener *et al.*, 2018). Shpendi *et*

al. (2024) also highlighted that young women who were HPV vaccinated were more likely to have attended screening compared to those not vaccinated. It is therefore important to explore further how being vaccinated encourages screening uptake through in-depth qualitative research.

Women now reaching the screening age for cervical cancer are the first cohort of women in the UK to have had the opportunity to receive the HPV vaccination. Research has not yet reported on the views of screening in this group of women. Insights from qualitative research would allow for a greater understanding of the impact of the vaccination on screening uptake for cervical cancer, whilst adding a more in-depth perspective to previous findings that have investigated factors that are most prominent for screening attendance. The current study aims to explore, via semi-structured interviews, the barriers and facilitators, including HPV vaccination, to attending cervical screening in women aged 24-30 years old who have (attenders) versus those who have not (non-attenders) attended their first cervical screening invitation. We aimed to gain a richer and more in-depth understanding of the decision-making process surrounding screening, which may contribute to refining initiatives to promote cervical screening.

3.2 Method

3.2.1 Participants

Participants were a convenience sample of young women eligible for screening based in the UK, recruited from online platforms (e.g., Twitter, Call for Participants and LinkedIn). Eligible participants were aged 24 – 30 years old, to recruit those who had reached the eligibility age of first invitation to the NHS cervical screening programme in the UK (24.5

years old), but also to allow for delayed uptake of screening. Those who had attended a cervical screening under the age of 24 years (before eligibility for the NHS screening programme), had a history of cervical cancer and/or had a hysterectomy procedure were not eligible to participate. Potential participants were first invited to complete a screening questionnaire that consisted of four questions to determine eligibility for the interview study (i.e., age, geographical location, whether they had been screened previously under the age of 24, and hysterectomy history) as well as one question on whether or not they had attended their first cervical screening to categorise participants into groups. Eligible participants were then contacted via email in the order they completed the screening questionnaire with further information about the interview study and available interview slots.

Braun and Clarke (2021a) have questioned the relevance of the concept of data saturation, as well as the practice of predetermining a required sample size, for reflexive thematic analysis. Instead, they argue that determining a sample size is a pragmatic exercise that should be decided *in-situ* (i.e., during data collection) and informed by the extent to which the data are adequate, in terms of their depth, richness and/or complexity, to address the research question. In the present study, it was decided to initially interview 12 attendees and 12 non-attendees, before deciding whether or not to interview further participants.

Online interviews were organised with those expressing an interest in participating until the initial recruitment quotas had been met (i.e., 12 participants per group). Participants were provided with a unique participant ID, a link to an information sheet and a consent form, to be completed before the interview. After completion of the interview, participants were sent an online shopping voucher via email (£20 Amazon voucher). The study received ethical approval from the University of Sheffield Research Ethics Committee (See Appendix F). See

Appendix G for the participant information sheet and consent forms, and Appendix H for the interview guide.

In total, 24 participants were interviewed, comprising 12 attendees and 12 non-attendees (see Appendix I for sample characteristics). The median age of the final sample was 27 (range = 26-29), all participants identified as women, and the majority were either partnered (n = 11) or married (n = 4). The majority of participants were HPV vaccinated (n = 13) and had received two or more doses (n = 8) (see Appendix K & I).

3.2.2 Interviews

Twenty-four in-depth online interviews were conducted (12 attendees and 12 non-attendees), between August and September 2022, by SS. Semi-structured interviews encouraged an open discussion and allowed participants to express themselves freely. Core questions focused on screening experiences, perceptions and attitudes towards screening, and knowledge and experiences of the HPV vaccination. The topic guide gave the researcher a flexible set of questions and prompts on relevant topics, allowing participants' views and experiences to influence the discussion (see Appendix H). SS regularly reflected in a diary on her subjective role within the interview process and analysis as a young woman within the eligibility age for this study, having attended her first cervical screening and with experience of the HPV vaccine. SS completed data collection and analysis from a critical realist position (Alderson, 2021), which recognises screening as a universal ‘procedure’ to which women have complex and varied experiences constructed through social phenomena and influence. Interviews were audio-recorded and transcribed verbatim. All participants provided consent and completed a demographic questionnaire, obtaining data about age, ethnicity, place of residence, education, relationship status, religion, and employment status. Interviews lasted a

median of 28 minutes (16-45 minutes) and were carried out by SS (See Appendix L for full demographic questionnaire).

3.2.3 Analysis

Reflexive thematic analysis (RTA) (Braun and Clarke, 2021b; Braun, Clarke and Hayfield, et al., 2023) enables flexible analysis and, most importantly, allows for analysing data inductively and deductively. RTA has been employed to explore people's experiences of a range of health issues (e.g. Bell et al., 2024; Clarkson et al, 2023; Plunkett and Pilkington, 2024). An important feature of RTA is that the researcher reflects on their role in knowledge construction throughout the research process. SS kept a reflexive diary during interviews and data analysis to draw on during analysis. This reflective practice served as a reminder of the objectives of the study and a way to acknowledge the researchers' biases and assumptions about the subject matter as a woman who closely identifies with the participants in the study.

RTA utilises both semantic codes and themes, referring to explicit and surface meanings of data and latent analysis that considers underlying ideas and/or patterns in the data. In the present study, data analysis comprised two stages. In stage 1 initial themes were generated using inductive reasoning, whereas in stage 2 deductive reasoning was used to map the themes onto the COM-B model components. A similar approach was followed by Moore, Cogan and Williams (2023) in their RTA of the impact of endometriosis on quality of life in which they used an inductive approach to identify initial themes, followed by a deductive approach to map the themes onto pre-established illness representation dimensions. Analysis for attendees and non-attendees was conducted separately and then combined. Data familiarisation began for SS by listening to the transcripts and transcribing the recordings verbatim. During stage 1, transcripts were coded by SS, who generated initial themes using

NVivo14 software. SS referred back to her reflective diary entries to refresh interview memory and recall initial observations, for example, participants' tone of voice and emotional cues when discussing points. No coding book was used, as RTA discourages coding books (Braun and Clarke, 2024). Questions that arose with the team during discussions and presentation opportunities at the time of analysis aided the development and review of initial themes. SS also used mind maps to visualise codes and initial themes when building the narrative of the findings and finalising the themes. In stage 2, the COM-B model was used to interpret the themes according to how they reflected the psychological constructs represented in the model by all authors.

3.3 Results

Figure 3.1 presents the six themes of barriers and facilitators to screening that were identified in Stage 1 of the analysis. In stage 2, five of these themes were then mapped onto COM-B model components (i.e., capability, opportunity, motivation), which left the remaining theme focusing on HPV vaccination, presented as a separate concept.

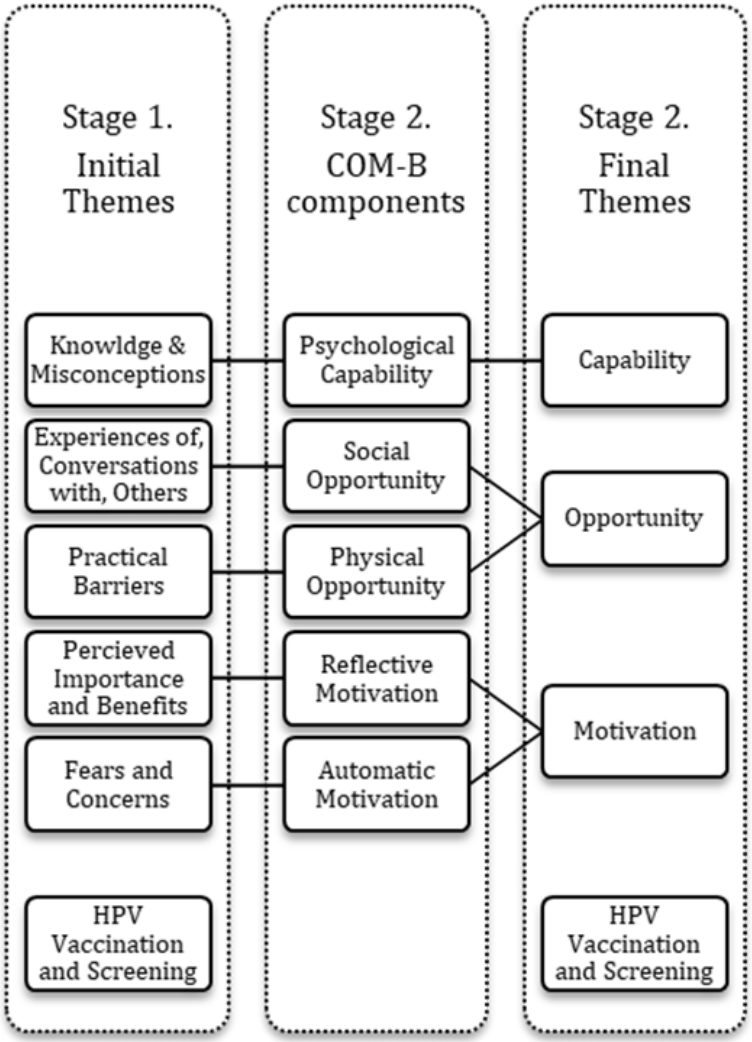

Figure 3.1 Visual representation of themes and two-stage analysis.

3.3.1 Stage 1: Inductive Analysis

3.3.1.1 Knowledge and Misconceptions

Unsurprisingly, attendees expressed more knowledge surrounding screening and the procedure than non-attendees, which may influence the uptake of screening. This was not only due to experiencing screening firsthand but also to more information-seeking behaviours, such as online searching and research about screening. The non-attendee group were aware of the initial age of eligibility for screening and were expectant of the invitation

but lacked knowledge of the procedure itself. Similar to attendees, non-attendees expressed a desire to research screening further but only some actively had done so.

> *"I'm not very familiar with the topic yet. And I wanted to do some research and understand what it's about and what it entails. So, once I have the understanding then I would make the decision of whether to go or not." (P20, non-attendee)*

Misconceptions surrounding the age of screening were one of the most prominent barriers to uptake amongst non-attenders. Participants expressed screening as something done when older and that they felt "too young" to attend, often referring to 30 years old and older, or relative to mothers and aunties.

> *"Yeah, I don't think I can take it too seriously because I feel like I am just still young." (P19, non-attendee)*

Most of the participants felt that improving education and awareness around the topic was the best way to improve knowledge about screening and the procedure. This was consistent across both groups, with school education as a common recommendation and a focus on specific aspects of what screening is and why it is done, to improve uptake. This also included the possibility of adding more information to the invitation and from GP/health worker settings, as well as hearing from other community members about their experiences.

> *"If I hadn't of been able to see the video or had sort of like people that I know, talked to me about the experience, or even had, like STI tests, like they were in a similar I've done this similar way. uhm I think I would have probably put it off like most people." (P5, attendee)*

Attendees shared coping strategies and recommendations for easing the screening experience. Further knowledge surrounding various options to personalise screening was also

highlighted as one way to improve confidence in screening and overall experiences. For example, one participant emphasised "distracting yourself" with music and maintaining personal hygiene to be more relaxed, whereas a few participants suggested bringing a friend or family member for moral support.

> *"Maybe kind of making it more clear to women or people have like uhm cervixes like what their kind of not rights what their kind of what they're entitled to in the procedure." (P10, attendee)*

The nature of cervical cancer was also highlighted as a facilitator to screening, as women were aware that cervical cancer can be asymptomatic, but treatable if diagnosed early.

3.3.1.2 Experiences of, and Conversations with, Others

Several attendees had experience and/or knowledge of a close family member's experience with cancer. Specific family histories of breast cancer, cervical cancer and ovarian cancer were shared by some, in which two of these cases were maternal figures. For some participants, maternal encouragement was a driver in attending their screening, as well as having friends and family working within the health industry.

> "*My mom is a nurse. So, she's always very hot on [me] attending these sorts of things*." (P4, attendee)

In attendees, overall conversations and open communication with friends and family about cervical screening and similar topics were common. Contrary to this, non-attendees highlighted a lack of conversation with friends and family, resulting in unawareness of those who had attended the screening or not in their close circles.

"I've got friends that have had issues, we're very open me and my friends about kind of, you know, all sorts like periods we like talk about it all. We're very open." (P4, attendee)

"Not really just like, it's like occasionally mentioned. Like, it's not like a topic of conversation or something." (P18, non-attendee)

"I haven't met anyone who has gone to get this screening. So, I don't know who to ask or like, does it hurt? Like, I don't know." (P14, non-attendee)

Negative experiences and stories were shared by friends and family with participants in both groups. However, the influence of this was more prominent amongst non-attendees. In the few instances where negative stories were shared, this worked to deter participants from screening. One participant who had missed an appointment due to illness had not rebooked due to negative stories shared via friends.

"Very uncomfortable they didn't feel well after and I think it just put me off as well cos I'm the sort of person that's quite squeamish about things anyway." (P23, non-attendee)

Non-attendees also expressed negative perceptions of, and previous interactions with, healthcare providers. In general, non-attendees did not express the same level of trust in healthcare services as attendees. Furthermore, attendees also frequently highlighted the role of the nurse/health worker during screening and the importance of friendliness and reassurance.

"They don't care, they don't care about how we feel. And so then that makes things like this, is it going to be a horrible experience?... I think that's that kind of general feeling that I have towards it," (P22, non-attendee)

"I think the best way to put it is that I trust the NHS. The NHS has always done right by me." (P9, attendee)

"It must be essential that the nurses you know, nice and calm and as I said, friendly, has a smile wants to be there." *(P4, attendee)*

Irrespective of screening uptake, both groups indicated that there was a lack of strong presence of screening topics on social media, but both felt this could be an opportunity to further spread awareness. However, the emphasis remained on encouragement and information coming from trustworthy sources, such as GPs and healthcare professionals, instead of social media.

3.3.1.3 Practical Barriers

Busy lifestyles were reported in both groups, but in particular amongst non-attendees when discussing the reasons for non-attendance. Specifically, this often referred to changing routines and work-life balance. Emphasis on the specific timing of invitations and personal availability at the time of reminders was also reported in both groups. Many attendees reported being caught at a 'good time', whereas non-attendees highlighted the importance of timing for them in aiding uptake.

"When I received the letter, I was quite, there wasn't many things on my mind, my schedule was fully empty. It wasn't a busy time of my life." (P6, attendee)

"I'm gonna start working. So you never, you never really know when you're going to be available." (P16, non-attendee)

A key issue for non-attendees was also negative perceptions and difficulties getting an appointment. They often referred to assumptions that GP booking services are inconvenient

and tedious, based on experiences of booking general appointments with GP services. Two participants explicitly stated that booking an appointment was the main reason for not yet having attended screening. However, the suggestion of pre-booked appointments as a solution yielded mixed responses; one participant felt this would help with hesitation in booking, whereas two others did not feel this would be convenient and rather increased pressure to attend.

> *"Because I'm assuming that it's not that I don't want to, I'd love to, I think the main problem is that you call them they'll probably say, well, we don't have any availability this week, or next week, or in a month, you can come in like six months, or something." (P16, non-attendee)*

> *"That's what puts me off because I know how hard it is to like speak to a- like get an appointment like speak to anyone at like the appointments desk." (P18, non-attendee)*

3.3.1.4 Perceived Importance and Benefits

Screening was frequently assumed as 'important', without often providing reasoning for this assertion. Most commonly, participants reported attending for 'reassurance', particularly through the 'knowledge' and 'confidence' in one's health. Consideration of the costs and benefits of screening was common, with one participant stating that, for them, "the advantages outweigh the disadvantages" (P7, attendee).

Similarly, around half of those in the non-attendee group also reported reassurance as a main reason why they would intend to screen in the future, as well as sharing the viewpoint that screening is important. The majority of participants in the non-attendee group also indicated an intention to screen.

"The top three reasons so I would say my health and reassurance... uhm so yeah reassurance that everything's all right" (P4, attendee)

"Something like this is quite good because you getting you know, the reassurance and everything's normal" (P19, non-attendee)

The most common reason for non-attendance among participants was a lack of priority setting when it came to booking and/or attending an appointment. Some examples of this were due to lower perceived risk amongst some in the non-attendee group, with a lack of symptoms and a low number of sexual partners as reasons for not attending the screening.

"Not actually booked in or did anything about it, because I thought, well, it's not really a priority right now." (P13, non-attendee)

3.3.1.5 Fears and Concerns

Participants across both groups expressed emotions related to embarrassment, fear and nerves when discussing screening. However, for non-attendee participants, this was cited as a barrier to screening and a reason for non-attendance. Although both groups expressed similar emotions, a clear difference was evident in the non-attendees' confidence in their ability to cope with screening and overcome these emotions and complete screening. The invasiveness of the procedure and the intimacy of the area seemed to "*put off*" participants from attending.

"Also a big part is just putting it off because I really didn't like the sound of having to do it - it's quite invasive." (P24, non-attendee)

"Difficult if it entails more than a regular visit to a gynaecologist and I'm already not happy with that. It's one of those. That's why I'm like, No, not for me. But I know it's necessary but at the same time I'm scared." (P14, non-attendee)

Fear or concerns about the result of the screening were mentioned in both groups but did not seem to impact uptake in attendees (perhaps because participants also felt that screening was important exactly because it could detect cervical cancer early). However, a lack of knowledge regarding results and details of what positive or negative results meant was apparent across both groups.

"I definitely worry about results and stuff" (P23, non-attendee)

For attendees, the preventative nature and opportunity to attend screening were also reported, with emphasis on the test being free. Similarly, non-attendees also mentioned this as a benefit to the screening process.

"I mean what would be more uncomfortable if I don't get it done and then there is like a problem later down the line it's better to kind of go and get it caught early if there is anything." (P11, attendee)

3.3.1.6 HPV Vaccination and Screening

Low awareness of the vaccination and the link with screening was evident across both groups; therefore, there was no indication that the HPV vaccination played an active role in the decision-making process for participants' screening behaviour.

"I've got the vaccine I feel like I didn't even really think about the fact that I'd had the vaccine when I went to screening." (P11, attendee)

"So I guess it's because I haven't really heard much about it. Again, I haven't thought about it until you asked." (P16, non-attendee)

Reactions to the effectiveness of the vaccination were also positive across all participants. Most participants were also aware that the vaccination was not fully protective, and that screening would still be needed.

> "Well, I will still go. *It's only 90% [effective against cervical cancer], there's 10% left"* (P4, attendee)

However, information about the vaccine's effectiveness also seemed to increase intentions to attend screening by assuring protection whilst also lessening concerns about screening outcomes, indicating a possible facilitating role of vaccination in screening.

> *"I think actually hearing that as well would probably make me more positive about going for my screening as well." (P23, non-attendee)*

On the other hand, one unvaccinated non-attendee also expressed more motivation to attend screening knowing that they did not have the vaccination. However, after discussing the HPV vaccination, some non-attendee participants did feel that being vaccinated meant they could "put [screening] to a later date" (P19, non-attendee) or be screened less regularly (P14, non-attendee). Some non-vaccinated participants from both groups also expressed more interest in taking the vaccine than attending screening.

> *"It wouldn't discourage me from screening from going and get in, and still having the smear test and everything." (P5, attendee)*

> *"If I could be offered a vaccine at this stage? I would do it. And I would also get the courage to go and get the screening over and done with." (P15, non-attendee)*

3.3.2 Stage 2: Deductive Analysis

The COM-B model (Michie, van Stralen and West, 2011) was used to provide an overarching theoretical framework for interpreting the initial themes identified in stage 1 of the data analysis, to represent the nature of the factors influencing screening uptake in behavioural terms. In the discussion between the authors, the themes were mapped onto COM-B model components as shown in Figure 1. We employed deductive reasoning to map themes to COM-B model components by analysing the extent to which each theme represented each concept. For example, the theme 'Knowledge and Misconceptions' illustrated how knowledge influenced screening uptake and was therefore mapped onto 'Psychological Capability', which refers to how an individual's capability leads to action. We were able to map each theme to each component of the COM-B model, except for 'Physical Capability' which was not discussed in our data. Further, it was not possible to map the theme ' HPV Vaccination and Screening' onto a COM-B model component and, as a result, it remained as a fourth, separate theme.

3.4 Discussion

The present study used the COM-B model of behaviour change to interpret barriers and facilitators to cervical screening among young women, focusing on first screening experiences and invitations. Inductive RTA identified six themes that were then mapped onto three COM-B model components, with an additional theme unique to this data set. Thus, we have conceptualised factors that influence screening uptake in attendees and non-attendees, into four final themes: Capability, Opportunity, Motivation and HPV Vaccination and Screening. Psychological capability varied between groups, with attendees sharing more knowledge about screening and the procedure, while age-related misconceptions were

prominent amongst non-attendees. Differences in social opportunities, such as open communication with friends and family, were some of the key differences cited between attendees and non-attendees. Greater reflective motivation, such as considering screening as "important" and a source of "reassurance", were important facilitators for both groups. In contrast, automatic motivation, particularly feelings of embarrassment, acted as a barrier for both groups. Finally, participants' decision to attend cervical screening or not did not appear to be influenced by HPV vaccination status.

Environmental contexts, specifically social influences, were one of the most widely cited factors that impacted screening behaviour and differentiated attendees from non-attendees. Attendees reported that open conversations with family and friends facilitated normalising and increasing screening awareness in this age group. However, these open conversations were not exclusive to screening but also extended to sexual and women's health topics in general, which aided in normalising the discussion of cervical screening. In contrast, lack of conversation and negative peer influence were cited multiple times by non-attendees, and although not explicitly reported as a barrier, could impact other factors such as knowledge and awareness of screening overall. However, participants who did not engage in conversation surrounding these topics recognised the benefit and sought more opportunities to discuss with friends and family (Coleman, Cox and Roker, 2007; Leahey *et al.*, 2011).

Limited knowledge and awareness of screening remain an issue with this age group, particularly among those who hadn't attended screening. Specifically, gaps in knowledge regarding the necessity for screening and the procedure were most prominent. Educational interventions could target specific age-related beliefs in this group, such as misconceptions about being "too young" for cervical screening. This misconception could also impact young women's perceived risk of cervical cancer, outweighing the known benefits and importance

of screening. Educational-based interventions may need to target both psychological capability and reflective motivation to be effective. Furthermore, healthcare professionals were a desired source of information and encouragement regarding cervical screening, as well as members of the community when discussing personal experiences. Although social media could be an avenue to explore for spreading awareness in younger generations (Plackett *et al.*, 2020), this age group may also benefit from reminders and prompts from their GP services to reinforce the importance of screening to increase psychological capability.

Motivational processes, both reflective and automatic were salient in both groups. Consistent with previous research (Shpendi *et al.*, 2024), emotional responses to screening (e.g., embarrassment, fear, and nerves) were consistently raised by both attendees and non-attendees as were concerns about the test result. It is striking that while both groups mentioned similar barriers, for many attendees, these concerns were offset by the potential benefits and the importance attached to screening. In addition, attendees reported employing various coping strategies, such as breathing and listening to music, to deal with fears and worries about attending screening. Highlighting such coping strategies in pre-screening information could benefit non-attendees. Interestingly, almost all non-attendees in the current study reported an intention to screen in the future. This may reflect an 'intention-behaviour gap' (Sheeran and Webb, 2016) such that positive intentions to attend cervical screening may not always translate into actual attendance at screening. Although intentions to screen are more prevalent in younger women when compared to older women (Waller *et al.*, 2012), younger women are less likely to attend than older women; for example, attendance rates are only 59.7% for 25-29-year-olds in England, compared with 72.1% for 45-49-year-olds (NHS Digital, 2021). This suggests that other factors, including those identified in the current study (e.g., embarrassment and worries) may prevent many young women from acting on their positive intentions to attend cervical screening. Tailored interventions that target the

commonly perceived barriers for this age group are likely to be required to increase uptake. Given that prior attendance at cervical screening is a strong predictor of continued attendance (Taylor-Phillips *et al.*, 2013; Labeit and Peinemann, 2015), it is imperative that young women are encouraged and supported to attend their first cervical screening appointment. Encouragingly, previous research suggests that interventions may be more successful among hesitant groups that show an intention to screen than among resistant groups with no intention to screen (Betsch, Korn and Holtmann, 2015). Although long-term non-attendance cannot be determined at the first invitation, targeting this group could be most effective as, if successful, this is likely to translate into continued attendance given that past behaviour is one of the strongest predictors of future behaviour (McEachan *et al.*, 2011).

Furthermore, as previously reported, healthcare providers also play a crucial role in screening uptake and experiences (O'Connor *et al.*, 2014). Negative interactions and practical barriers to accessing healthcare services were noted among non-attendees in the current study, leading to further fears of being 'dismissed' or 'not taken seriously'. Healthcare providers could use their position positively to influence screening uptake in young women. Specifically, healthcare providers were considered the most desired source of information and encouragement when it came to screening. A desire for a female nurse or healthcare provider was prominent, as well as options to further 'customise' the experience to aid young women during screening. For example, some participants weren't aware they could choose to be accompanied by someone to the appointments and during if desired, highlighting a further lack of knowledge regarding screening options.

An important finding in this study emphasised the role of participants' attitudes and perspectives on the HPV vaccination on cervical screening attendance. Participants stated that the effectiveness of the HPV vaccination would increase their confidence in attending

screening, and news of the vaccine's effectiveness was well received. Perhaps contrary to expectations, a novel finding of this study is that participants reported that they did not necessarily consider their vaccination status in their decision to screen, indicating that vaccination status may not be predictive of screening uptake. Improving HPV vaccination knowledge and awareness may boost screening uptake, however, by providing young women with education on the benefits of the vaccination, whilst alleviating stressors linked with cervical screening results and emphasising the advantages of being vaccinated. This highlights a possible avenue to utilise the HPV vaccination as a facilitator in future interventions to promote screening.

The current study had a number of strengths. Most notably, the use of semi-structured interviews allowed for flexibility to explore in-depth, women's views on cervical screening. Furthermore, the RTA enabled a two-stage analysis process whereby inductive reasoning generated themes that gave insight into barriers and facilitators to screening, whilst a second deductive analysis stage allowed us to map these themes onto a theoretical model of behaviour change, the COM-B model. It should be noted that the principal researchers' position within RTA may have influenced data collection and analysis, given their demographic and previous research on the topic. However, this was managed throughout by active reflection. Reflexive practice supports the flexible, yet systematic approach to thematic analysis and is considered a strength of this method, which values the researcher's subjectivity and in-depth interaction with the data as the primary tool in discerning meaning from data (Braun and Clarke, 2021b). Reflective notes also illustrated the benefits of the researchers' demographic in helping to create rapport with participants during interviews. Given the sensitivity of the topic and personal experiences being shared, discussing this with someone of a similar age and gender can help create a more open and understanding environment during interviews.

Another key strength of the study is that it was carried out at a unique period during which the first HPV vaccination cohort became eligible for screening under the NHS (24.5 years old and older). This allowed for discussion of HPV vaccination and screening with a sample of first-invitation attendees and non-attendees. However, previous qualitative research has suggested that participants are not always consciously aware of the 'real' reason for screening attendance or non-attendance (Waller *et al.*, 2009), therefore it is common to see similar explanations and emotions shared. For example, negative attributes of screening (e.g., embarrassment) are frequently used as justification for non-attendance; however, these attributes are also equally cited by attendees. Future quantitative research might validate the present findings by assessing the prevalence of these barriers and facilitators and the strength of their relationships with screening behaviour in a larger sample of young women.

3.5 Conclusion

Cervical screening behaviour is complex and presents unique challenges in ensuring young women are adequately informed and encouraged to attend. Our findings suggest that more prompts and accurate information are needed from healthcare professionals, as well as encouragement to engender open discussions amongst peers. Furthermore, addressing factors that may be hindering those with positive intentions to attend cervical screening, such as feelings of embarrassment regarding the procedure, is crucial to increasing the uptake of cervical screening in young women. Future work could also examine further the impact of the HPV vaccination and how this could be utilised to promote attendance at cervical screening.

Chapter 4 Cross-sectional survey study of Cervical Screening

4.1 Introduction

Globally, cervical cancer remains the fourth most common cancer in females, with 350,000 deaths worldwide each year (WHO, 2024). There are around 3,000 new cases a year of cervical cancer (CC) in the UK. Epidemiological studies have revealed the highest prevalence of preinvasive CC lesions, which without treatment may develop into invasive carcinoma, is in females aged 25-29 (Cancer Research, 2019). In addition, the peak incidence rate of cervical cancer has been observed in younger age groups, with 30-34-year-olds making up 15.2% of cases, closely followed by 25-29-year-olds making up 13.4% of cases (NHS England, 2023).

CC cases have declined over the last decade, partly due to the availability of the National Health Service (NHS) cervical screening programme and the success of the HPV immunisation programme (Falcaro et al., 2021). In 2018, the World Health Organisation called for coordinated global action to eliminate CC, ensuring that 90% of all girls are vaccinated against HPV and that at least 70% of women are screened by age 35 (WHO, 2024). However, both attendance and vaccination rates have fallen in recent years (UK Health Security Agency, 2022; Urwin et al., 2024). For example, vaccination coverage in 2022 to 2023 was 4.4% lower compared to coverage in 2021 to 2022 (67.3% coverage rate), as well as 21% lower than pre-pandemic levels (2018 -2019) in England (UK Health Security Agency, 2024). Given that the HPV vaccine is only 90% effective, those vaccinated still require cervical screening to mitigate this risk further (Falcaro et al., 2021). Moreover, the sizeable minority of young women who are unvaccinated may be at heightened risk, further reinforcing the need for cervical screening.

Cervical screening programme uptake remains central to early diagnosis, as CC can be asymptomatic in the early stages as and can go undetected for many years; 99.8% of CC cases are preventable with early detection (Roope, 2021). Currently, the NHS aims to achieve cervical screening coverage of 80% of eligible individuals. In 2024, only 68.8% of those eligible attended screening within the last 3.5 years, which saw only a 0.1% increase from the previous year (NHS England, 2024). Moreover, younger age groups are far less likely to attend screening than older age groups (59.7% of 25-29-year-olds versus 72.1% of 45-49-year-olds) (Digital, 2021). Therefore, many young women in the UK do not respond to their first screening invitation at the age of 25. First-time screening experiences are particularly important as they can have a significant positive impact on the trajectory of future screening attendance. Evidence has shown that past behaviour is one of the strongest predictors of future behaviour (McEachan et al., 2011), highlighting the need to understand and address the barriers to initial screening attendance.

Previous research has examined several factors associated with CC screening uptake in young women, including knowledge and awareness (Ackerson et al., 2008; Enyan et al., 2022), socioeconomic status and healthcare access (Urwin et al., 2024). Similarly, a recent systematic review (Shpendi et al., 2025a) highlighted several studies reporting a significant positive relationship between knowledge and screening attendance. In addition, those in a relationship, sexually active and/or HPV vaccinated were also more likely to have attended CC screening. The review also highlighted communication with friends as a prominent facilitator, and financial constraints, embarrassment, and low accessibility as key barriers, to screening uptake.

Theoretical frameworks, like the COM-B model of behaviour change, can provide an overarching framework to capture the factors that may influence CC screening behaviour and provide a structure for developing interventions to increase the uptake of CC screening (Michie et al., 2011). The COM-B model states that for the behaviour to take place, an individual must have: 1) the physical and psychological capability to perform the behaviour; 2) the physical and social opportunity to do so; and 3) reflective (conscious thought and decision-making) and automatic (habits and subconscious processes) motivation (Michie et al., 2011). The COM-B model has been used to explain a range of health behaviours including Covid-19 protection behaviours (Gibson Miller et al., 2020), physical activity (Howlett et al., 2019) and healthy eating (Isbanner et al., 2024). Considering cervical screening, a previous qualitative study used the COM-B model to interpret current barriers and facilitators for both attendees and non-attendees in young women (Shpendi et al., 2024). Reflective motivations (e.g., reassurance) and automatic motivations (e.g., embarrassment) were key facilitators for attending CC screening in both groups. However, social opportunity factors (e.g., open communication) were reported predominantly among attendees, highlighting the need for more open communication amongst social circles for those who had not attended. Non-attendees also reported automatic reflective motivations in the form of negative perceptions and past interactions with healthcare providers, contributing to their reluctance to participate in screenings. These barriers can also be heightened for those with comorbidities (Kiefe et al., 1998) or other health problems (Akinlotan et al., 2017). Similarly to the previous review (Shpendi et al., 2025a), participants did not report physical capability factors (e.g., not having the strength to attend screening) as barriers to attendance and therefore were not assessed in the current study.

The current study aims to compare young women and people with a cervix who haven't versus have attended CC screening on the COM-B components identified in a recent

qualitative study (Shpendi et al., 2024). In addition, the study will consider HPV vaccination status and demographic characteristics as additional predictors of CC screening attendance.

4.2 Materials & Methods

4.2.1 Sample Recruitment

The study received ethical approval from the University of Sheffield Research Ethics Committee (See Appendix M). Participants were women based in the UK aged 25 - 30. Exclusion criteria included: women who have had a cervical screening before being invited as part of the government cervical screening programme (i.e., before the age of 24), women with a personal history of cervical cancer or hysterectomy procedure, and women who cannot read or write in English.

Participants were recruited online using Prolific, using filters to specify the target population. These included age (25 - 30), sex (female) and area of residence (UK) to meet the eligibility criteria. In total 5,352 participants on Prolific were eligible for recruitment. Participants were recruited in two stages: first, a screening survey to assess inclusion/exclusion criteria and attendance status and second, the main survey. Data were collected online through surveys hosted via Qualtrics. For the screening survey, 1,000 participants were recruited. Eligible participants who met the inclusion/exclusion criteria were then split into attendees and non-attendees, depending on screening questionnaire responses. From these participants, all eligible attendees and non-attendees were invited to participate in the main study until 100 in each group had been recruited. Data collection took place between 8-10 December 2023. See Appendix N for participant information sheet and consent form.

4.2.2 Sample Size

Based on a previous study that examined psychological factors associated with screening attendance (e.g., perceived efficacy and awareness of cervical screening), an odds ratio of 2.00 was used as an estimate of the likely effect size for differences between attendees and non-attendees (Hansen et al., 2011). A power calculation indicated that the minimum sample size to detect a small to medium effect size/odds ratio of 2.00 with 90% power is 148 participants. To account for dropouts and poor-quality data, this was increased to 200 (100 attendees and 100 non-attendees).

4.2.3 Measures

A screening questionnaire was used to identify eligible participants based on the inclusion/exclusion criteria (i.e., “Have you ever been diagnosed with cervical cancer, had a hysterectomy procedure and/or had a positive pap smear result (if applicable)?” and “Did you attend your cervical screening before the age of 24.5 years old?”) and to obtain responses regarding attendance status (attendee or non-attendee) (i.e., “Have you attended a cervical cancer screening? (also known as a pap smear)?”) and invitation status (“Have you received your cervical screening invitation letter?”).

The main questionnaire included questions regarding education (“What is the highest degree or level of education you have completed?”), relationship status (“What is your current relationship status?”), religious status (“What religion do you identify most with?”), HPV vaccination status (”Have you had the HPV vaccine?”), self-rated health (“How would you rate your health status?”) (Bowling, 2005) and identification of any long-standing illness, disability, or infirmity (Manor et al., 2001). Prolific provided further demographic data (i.e., employment status and age).

The COM-B model components were assessed using a structure by Keyworth et al. (2020) and including factors identified in a previous systematic review (Shpendi et al., 2025a) and qualitative study (Shpendi et al., 2024). Items were rated on an 11-point scale ranging from "-5" (strongly disagree) to "+5" (strongly agree) and averaged to produce a scale score for each COM-B model component (see Appendix O for the full list of COM-B model items included). The first item of each COM-B component was also accompanied by a brief description as recommended by Keyworth et al. (2020) (see Appendix O for full questionnaire). *Physical capability* was not assessed in the current study as it was not highlighted as an important component in an earlier qualitative study with the same target population (Shpendi et al., 2024).

Psychological capability was assessed using a general statement adapted from Keyworth et al. (2020) (i.e., "I am psychologically able to attend cervical cancer screening") followed by nine items on different aspects of psychological capability to attend (e.g., "I know what cervical cancer screening is for"). Cronbach's alpha for the scale was .74.

Social opportunity was assessed using a general statement (i.e., "I have the social opportunity to attend a cervical cancer screening") followed by six items related to social opportunity (e.g., "I am comfortable discussing cervical cancer screening experiences with my social circle"). Cronbach's alpha for the scale was .76.

Physical opportunity was assessed using a generic statement (i.e. "I have the physical opportunity to attend cervical cancer screening") followed by four items related to physical opportunity (e.g., "Booking a cervical cancer screening is difficult for me"). Cronbach's alpha for the scale was .72.

Reflective motivation was assessed using a generic statement (i.e., "I am motivated to attend cervical cancer screening") followed by nine items reflecting reflective motivation (e.g., "Cervical cancer screening is important"). Cronbach's alpha for the scale was .85.

Automatic motivation was assessed using a generic statement (i.e., "Attending cervical cancer screening is something that I do automatically") followed by five items assessing aspects of automatic motivation (e.g., "Cervical cancer screening is embarrassing for me"). One item ("I am scared of the cervical cancer screening procedure") was removed to improve reliability from .61 to .70.

4.2.4 Analysis

SPSS (Version 29) was used for statistical analysis. Descriptive analyses were used to describe sample characteristics. Due to small sample sizes in some categories, nominal demographic variables (e.g. ethnicity and education status) were dichotomised into binary variables, for variable grouping and reference categories (see Appendix P and Appendix Q). Continuous demographic variables were reported using means and standard deviations (e.g. age and health status). An average score for each COM-B component was calculated for each participant. The two groups (attendees vs non-attendees) were compared on their demographic characteristics and the COM-B model components using unadjusted (i.e., univariate) logistic regression analysis. Demographic variables that reached a p-value of $< .05$ were then subsequently controlled for in a multiple logistic regression containing all COM-B model components. The degree of association between independent variables (e.g., COM-B model components) and the dependent variable (i.e., attendance versus non-attendance) was analysed using odds ratios with 95% confidence intervals. Statistical significance was observed at $p < .05$. Additional analyses reported in the Supplementary Materials also examined associations between each of the COM-B model items and screening attendance

(See Appendix R & S). As invitation status is not an eligibility criterion for attending cervical screening in the UK, and those of eligible age and biological gender can still book and attend cervical screening, this study therefore included participants who have and have not received a cervical screening invitation letter. However, an additional sensitivity analysis was conducted, excluding those who had not received a cervical screening invitation (see Appendix S).

4.3 Results

4.3.1 Participant Characteristics

In total, 200 participants aged 25 - 30 were recruited for the main study, comprising 100 attendees and 100 non-attendees. The mean age of participants was 27.60 (*SD* = 1.76). The majority of participants identified as female (96%), were white (77%) and had attended higher education (education beyond school level) (79%). Most participants reported that they had received a screening invitation (90%) and were HPV vaccinated (70%), with 53% reporting having received two or more doses. Demographic details are provided in Appendix J. For full demographic frequencies, see Appendix K.

4.3.2 Demographic Factors Associated with Screening Attendance

The odds of having attended cervical screening were significantly associated with being older (OR, 1.21; 95% CI, 1.03 - 1.43), being partnered (OR, 1.78; 95% CI, 1.01 - 3.15), and being in employment (OR, 2.77; 95% CI, 1.18 - 6.52). In contrast, being religious (OR, 0.52; 95% CI, 0.28 - 0.97) and having a longstanding illness or disability (OR, 0.33; 95% CI, 0.15 - 0.74) were negatively associated with having attended cervical screening (See Appendix J).

The odds of cervical screening attendance were also higher in those who had received the HPV vaccination in comparison to those not vaccinated (OR, 2.17; 95% CI, 1.11 - 4.23). Screening attendance was also higher among those who had received a screening invitation (OR, 5.40; 95% CI, 1.50 - 19.43) (See Appendix J).

When excluding participants who had not received a cervical screening invitation, sensitivity analysis showed that being in a relationship (OR 2.05; 95% CI, 1.12 – 3.75) and being in employment (OR 3.15; 95% CI, 1.31 – 3.15) and having a longstanding illness or disability (OR 0.33; 95% CI, 0.14 – 0.76) were significantly associated with screening attendance (see Appendix K).

4.3.3 COM-B Model Components Associated with Screening Attendance

Table 4.1 presents the results of the unadjusted (univariate) logistic regression analyses testing associations between each COM-B model component and cervical screening attendance. All of the COM-B model components were found to have a significant association with cervical screening attendance. Increased scores in Psychological Capability (OR, 1.90; 95% CI, 1.45 - 2.50), Social Opportunity (OR, 1.48; 95% CI, 1.26 - 1.74), Physical Opportunity (OR, 1.98; 95% CI, 1.56 - 2.52), Reflective Motivation (OR, 2.71; 95% CI, 2.07 - 3.54) and Automatic Motivation (OR 2.01; 95% CI, 1.61 - 2.51) significantly increased the odds of attending screening. Additional unadjusted (univariate) logistic regression analyses were conducted to test associations between each of the reflective motivation items and cervical screening attendance. Seven (out of ten) of the items were predictive of cervical screening attendance (see Appendix L). All COM-B components were also found to have a significant association with cervical screening attendance in the sensitivity analysis (See Appendix M).

Table 4.1 COM-B components and associations with screening attendance

Variable	Attendees	Non-attendees	Unadjusted OR (95% CI)	*P - value*
	Mean (SD)	Mean (SD)		
Psychological Capacity	3.31 (1.00)	2.42 (1.37)	1.90 (1.45 - 2.50)	<.001*
Social Opportunity	2.45 (1.73)	0.95 (2.15)	1.48 (1.26 - 1.74)	<.001*
Physical Opportunity	3.84 (1.18)	2.69 (1.33)	1.98 (1.56 - 2.52)	<.001*
Reflective Motivation	3.67 (1.12)	1.53 (1.62)	2.71 (2.07 - 3.54)	<.001*
Automatic Motivation	2.55 (1.50)	0.70 (1.74)	2.01 (1.61 - 2.51)	<.001*

Note. * $p < .05$.

4.3.4 Multiple Logistic Regression Analysis Predicting Screening Attendance

A multiple logistic regression analysis was conducted in which all of the COM-B model components were entered, along with the covariates of age, ethnicity, relationship status, religion, employment status, longstanding illness status, CC screening invitation and HPV vaccination status. Together, these variables significantly predicted screening attendance versus non-attendance, $\chi^2(13) = 104.70$, $p < .001$. Reflective motivation was the only COM-B model component that was a significant independent predictor of screening attendance, such that increased reflective motivation scores increased the odds of having attended cervical

screening (OR, 2.79; 95% CI, 1.65 - 4.72). Age (older) and relationship status (partnered) were also significant independent predictors of screening attendance in this analysis (see Table 4.2).

The sensitivity analysis found reflective motivation as the only significant COM-B component predictor of screening attendance (OR, 2.37; 95% CI, 1.47 – 3.83), when also controlling for relationship status, employment status and longstanding illness status. Longstanding illness was also a significant independent predictor of screening attendance (see Appendix M).

Table 4.2 Summary of multiple logistic regression analysis predicting screening attendance.

Variable	**Adjusted OR (95% CI)**	***p - value***
Age	1.57 (1.10 - 2.22)	.011*
Ethnicity		
Non-White	0.71 (0.17 - 3.00)	.639
White	Reference	
Relationship Status		
Partnered	3.30 (1.03 - 10.34)	.044*
Other	Reference	
Religion		
Religious	0.54 (0.17 -1.77)	.308
Not Religious	Reference	
Employment		.809
Not employed	0.82 (0.16 - 4.10)	.809
Employed	Reference	
Longstanding Illness		
Yes	0.39 (0.10 - 1.67)	.204
No	Reference	
Screening Invitation		.012*
Yes	26.57 (2.10 - 340.15)	.012*

No	Reference	
HPV Vaccination		
Yes	3.10 (0.83 - 11.64)	.094
No	Reference	
Psychological Capacity	1.18 (0.63 - 2.20)	.610
Social Opportunity	0.82 (0.56 - 1.22)	.331
Physical Opportunity	1.42 (0.83 - 2.41)	.198
Reflective Motivation	2.79 (1.65 - 4.72)	<.001*
Automatic Motivation	1.16 (0.75 - 1.80)	.506

Note. * $p < .05$.

4.4 Discussion

Cervical screening uptake in the UK has declined in recent years but remains the most effective way for early detection and treatment of CC (Urwin et al., 2024). The present study aimed to examine factors associated with screening attendance in young women and people with a cervix in the UK. Several demographic factors were identified as significantly associated with screening behaviour. The strongest demographic predictors for having attended cervical screening were being employed, white ethnicity or being partnered. In contrast, being religious or having a longstanding illness or disability decreased the likelihood of utilising cervical screening. Furthermore, those who were HPV vaccinated were more likely to have attended cervical screening compared to those who were not vaccinated. It is possible that HPV vaccination may improve CC screening uptake by raising awareness of the link between HPV and CC. Being HPV vaccinated may also reinforce positive health behaviours and empower young women and people with a cervix to take up health screening invitations, as well as help reduce anxieties or offer reassurance about the likelihood of receiving positive screening results, thereby increasing attendance. Demographic factors associated with screening behaviour can also inform the development of interventions to increase the uptake of cervical screening, for example through tailoring interventions to target specific groups (e.g., ethnic minorities, single women, etc.). Previous qualitative findings suggested education from community members could be one way to improve awareness and uptake among minority groups (Shpendi et al., 2024). It is also important to note that receiving a screening invitation was also significantly associated with screening attendance. There can be a number of reasons why individuals may not receive a screening invitation letter. For example, errors made by a private sector company, Capita, contracted to provide GP support services, resulted in over 43,000 women not receiving an invitation letter

(Torjesen, 2019). In addition, young people may move home frequently and therefore may miss invitation letters sent to a previous address. Although all women and people with a cervix are eligible by age and can still book and attend cervical screening under the NHS, this may result in unique barriers to attendance in this subgroup. Nonetheless, motivations to attend may still be important in this subgroup, given that a number of participants in the current study who hadn't received an invitation letter reported having attended cervical screening.

All of the COM-B model components assessed in the current study were found to be associated with screening attendance. Thus, increased scores in psychological capability, social opportunity, physical opportunity, reflective motivation and automatic motivation were associated with an increased likelihood of having attended screening. When all of the COM-B model components and the demographic covariates were considered together, reflective motivation was the only COM-B model component that was a significant predictor of screening behaviour. Reflective motivation refers to the conscious, deliberate processes influencing behaviour, such as beliefs, intentions, values and goals (Michie et al., 2011). The importance of intention in cancer screening has been reported in previous studies on colorectal cancer (Christou & Thompson, 2012), CC (Lahole et al., 2024; Ogilvie et al., 2013) and general cancers (Ewing et al., 2023) and is a prominent factor in many models of health behaviour, including the theory of planned behaviour (Ajzen, 1991) and protection motivation theory (Prentice-Dunn & Rogers, 1986).

The current findings are consistent with previous literature (Bowyer et al., 2014; Shpendi et al., 2025b) and highlight that reflective motivation factors could be used as targets for future interventions to improve screening uptake, such as increasing awareness of the benefits of screening or self-efficacy. Understanding and targeting motivational components could be fundamental for improving screening uptake. A meta-analysis by Sheeran et al.

(2016) found that interventions that successfully changed attitudes, norms and self-efficacy produced significant changes in intentions, suggesting that interventions targeting these factors might increase reflective motivation factors and attendance at CC screening. Webb and Sheeran (2008) also reported that interventions that successfully changed intentions produced significant changes in behaviour. Previous intervention studies have utilised motivational messages in improving cancer screening uptake (Chan & So, 2021). These findings showcase the potential for targeting motivational factors to increase the intention to participate and actual screening behaviours.

The Human Behaviour-Change Project (HBCP) has sought to connect behaviour change techniques (BCTs) to underlying mechanisms of action (MoAs), helping identify specific BCTs that can effectively increase motivation (Carey et al., 2019; Connell et al., 2019). Understanding and targeting reflective motivation is crucial for developing interventions to increase CC screening uptake in young women and people with a cervix. For example, BCTs such as pros and cons, aiding mental rehearsals of the procedure and emphasising self-incentives through educational materials, could be used to target reflective motivation to attend CC screening. Additional analyses in the current study (see Appendix L) also highlighted which individual reflective motivation items were significantly associated with CC screening attendance. This additional analysis highlighted items referring to the 'importance' of screening and screening being 'worthwhile' as having significant associations with CC screening attendance. Future interventions could target these reflective motivational aspects in order to encourage CC screening attendance.

4.4.1 Study strengths and limitations

The current study has several strengths. First, the questionnaire was based on previous qualitative work (Shpendi et al., 2024), and the COM-B model provided a strong theoretical

framework. Significant associations were found between the COM-B components and cervical screening attendance, with reflective motivation emerging as the key predictor of attendance behaviour. Second, the use of the online platform 'Prolific' ensured a wide reach of participants for recruitment across the UK. Pre-screening filters also allowed for accurate recruitment of the desired population and the identification of attendee and non-attendee groups.

However, the study also had some limitations. First, the current study did not assess physical capability and therefore did not provide a full test of the COM-B model. However, previous research (Shpendi et al., 2024) did not identify physical capability as an important factor for CC screening attendance in young women in the UK. Second, the sample comprised a predominantly White and educated majority which may limit the generalisability of the results. For example, those from more marginalised groups may report more barriers related to social and physical opportunity than reported in the current study. Furthermore, the current study was powered to analyse the factors associated with screening behaviour in young women and people with a cervix and was therefore not powered to identify factors associated with CC screening attendance in individual subgroups (e.g., ethnic minority groups and lower socioeconomic status groups). For example, socioeconomic status has been associated with screening attendance for cervical (Wearn & Shepherd, 2022) and other (Schootman et al., 2006; Wells & Horm, 1998) cancers. However, in line with many models of health behaviour (Connor & Norman., 2015) the impact of socioeconomic status on screening attendance is likely to be mediated by social cognitive variables such as self-efficacy and perceived psychological costs (Orbell et al., 2017). Nonetheless, future research should be adequately powered to allow subgroup analysis in order to establish whether the factors associated with CC screening behaviour are consistent, or vary, across different population subgroups. Third, the use of convenience sampling can result in a rapid-responder

bias (*Prolific*, 2024); therefore, consideration was given to the time and day of the week that the study was launched. The study was made public outside of working hours (9 am - 5 pm) to allow those with daytime commitments an opportunity to respond.

4.5 Conclusion

Reflective motivation factors are key in promoting cervical screening attendance in young women. Future work should utilise BCTs, such as pros and cons and self-incentives, in educational materials to increase reflective motivation to attend cervical screening in young people. Demographic factors that can also significantly impact screening uptake should be considered when tailoring interventions to this age group. Addressing these factors may have a positive impact on boosting cervical screening attendance among young women, consequently reducing future mortality rates.

Chapter 5 The Impact of a COM-B Model Infographic on Intention to Attend Cervical Screening: A Randomised Controlled Trial

5.1 Abstract

Objectives. There are around 3,000 new cervical cancer (CC) cases yearly in the UK. According to recent figures, screening attendance is lower in young females. The current study tests whether a CC screening infographic intervention increases screening uptake intentions in young females (before their first screening invitation).

Design. Randomised Controlled Trial.

Methods. 251 young females were recruited into a randomised control trial (126 control and 125 intervention). Participants had to be 23 years old and must not have attended a cervical screening prior. Participants completed a pre-intervention questionnaire before viewing the control infographic (a simple statement from the NHS cervical screening site) or the intervention infographic (based on the COM-B model of behaviour change). Participants then completed a post-intervention questionnaire measuring their reflective motivations, intention strength and engagement with the infographic.

Results. A significant difference in engagement was found between the control and intervention infographics. However, there were no significant differences between the conditions in mean intention strength and reflective motivation. Moderated regression analysis provided some evidence that the intervention would be effective in those with neutral or negative intentions to attend screening.

Conclusions. The intervention infographic demonstrated a significant increase in engagement compared to the control group, suggesting that visual aids like infographics can

enhance engagement. However, additional strategies may be required to increase intentions and motivations to attend screening. Future research could target weak screening intentions.

5.2 Introduction

Cervical cancer (CC) screening rates in the United Kingdom (UK) remain well below government-set targets of 80% coverage of those eligible and have seen a decrease in recent years (NHS England, 2023). Despite the availability of free cervical screening under the National Health Service (NHS), only 68.8% of those eligible attended screening within the recommended interval (NHS England, 2024). Furthermore, younger females (59.7% of 25-29-year-olds) are less likely to attend than older females (72.1% of 45-49-year-olds) (NHS Digital, 2021). CC is predominantly caused by the Human Papillomavirus (HPV), and recent research has highlighted that introducing the HPV immunisation programme in 2008 has resulted in a steep decline in CC incidence in the UK. However, given that vaccination is not 100% protective and not all eligible females are vaccinated, screening remains central to early diagnosis, with 99.8% of CC cases being preventable (Roope, 2021).

Although long-term non-attendance cannot be determined at the first invitation, targeting a younger, at-risk group could be most effective, as, if successful, this is likely to translate into continued attendance given that past behaviour is one of the strongest predictors of future behaviour (McEachan et al., 2011). A recent systematic review identifying barriers, facilitators and factors associated with screening in young females identified knowledge of CC as a key facilitator in attending screening (Shpendi et al., 2025a). Furthermore, a qualitative study identified age-related misconceptions about screening as a key barrier, such as a belief that screening is only for older females. In addition, perceptions of the importance of screening and reassurance were identified as key facilitators to attending screening (Shpendi et al., 2024). These findings were corroborated in a cross-sectional study employing

the COM-B (Capability, Opportunity, Motivation, and Behaviour) model of behaviour change that reported reflective motivational factors (e.g., conscious decision-making and beliefs) as a significant predictor of screening attendance among young females (Shpendi et al., 2025b). The COM-B model states that for an individual to perform the behaviour, they must have 1) physical and psychological capability; 2) physical and social opportunity; and 3) reflective and automatic motivation to perform the behaviour (Michie et al., 2011). Previous research has also highlighted the influence of reflective motivational processes in association with cervical screening non-attendance (Hoque et al., 2014; Kaneko, 2018; O'Donovan et al., 2021).

In order to increase the uptake of cervical screening in young females, interventions are needed to target reflective motivational components and misconceptions about cervical screening. One way to increase motivation to attend cervical screening is through the use of educational infographics. Infographic is an abbreviated term for an information graphic that visually represents information, often including pictures, text and data (Krum, 2013). Previous studies have demonstrated that infographics can enhance understanding of, and engagement with, health information (McCrorie et al., 2018; Spiegelhalter et al., 2011), as well as increase knowledge and behaviour (Kong et al., 2025). For example, a study by Harrison et al. (2020) found significant increases in short-term knowledge of physical activity when usual education was supplemented with an infographic regarding physical activity during pregnancy with gestational diabetes mellitus. Thus, infographics can provide a brief and engaging resource for communicating health and risk information, which is crucial for individuals to make informed health decisions (Hawley et al., 2008). In the context of cervical screening, infographics offer a simple and effective intervention that could be seamlessly incorporated into the existing NHS cervical screening invitation, with the flexibility to be scaled in physical and digital formats. Previous research has tested the use of

infographics on females eligible for screening. Waite et al. (2023) found that a generic infographic resulted in significantly higher intentions to screen and more positive beliefs about screening benefits compared to a control infographic. However, a content analysis of multiple online infographics targeting healthy eating identified a lack of theoretical constructs included in the infographics. For example, only around half the infographics focused on behaviour capability constructs, such as tools and resources on how to make the new behaviour easier to perform. This led to a call for the increased implementation and dissemination of theoretical constructs in health-related infographics (Wilkinson et al., 2016).

The current study utilised the behaviour change wheel (Michie et al., 2011), a larger framework that incorporates the COM-B model of behaviour change, to guide intervention design. The infographic tested in the current study targeted reflective motivations and psychological capability to promote screening uptake, drawing on previous findings on the need to target reflective motivations (Shpendi et al., 2025b). Furthermore, as the majority of those invited to cervical screening will now be HPV vaccinated under the HPV immunisation programme (UK Health Security Agency, 2022), infographics could use targeted information about the HPV vaccine to reinforce previous findings of the positive impact vaccination can have on screening uptake (Beer et al., 2014; Miyoshi et al., 2021; Sauer et al., 2015). Indeed, previous qualitative research has identified a lack of awareness of the link between the HPV vaccination and cervical cancer and a positive response to information about the success of the HPV immunisation program (Shpendi et al., 2024).

Additionally, other research has identified several barriers to interpreting the current "NHS Cervical Screening: Helping You Decide" information leaflet that accompanies NHS cervical screening invitation letters. These barriers include misunderstandings around numerical information concerning the benefits of screening and key aspects of HPV (Okan et al., 2019). Cervical screening information is often presented in a way that is too complex for

people to understand, identifying the need for simple and effective methods to communicate essential screening information. Furthermore, Kobayashi et al. (2016) found that the majority of unscreened participants for colorectal cancer screening had not read nor engaged with the 'Bowel Cancer Screening: The Facts' booklet that is intended to provide essential information about bowel cancer screening. On the contrary, a previous study reported that presenting health data in an infographic motivated participants to address relevant health issues and helped them engage with the data (Arcia et al., 2016), highlighting the necessity and need for providing information in a way that is actively engaging for the public.

Cervical cancer remains a public health concern worldwide and in the UK. The present study aims to test the impact of reading a cervical screening infographic compared to a control infographic on young females' intentions and reflective motivations to attend cervical screening. The study will also test whether the cervical screening infographic is more engaging than the control infographic.

5.3 Materials and Methods

The full details of the study methodology, eligibility criteria, and study documents can be found on the Open Science Framework (osf.io/jycw4). This study was funded by the University of Sheffield and was pre-registered on 17th July 2024. No conflict of interest was declared by the authors. The study received ethical approval from the University of Sheffield Research Ethics Committee (See Appendix T). See Appendix U for the participant information sheet and consent form, and Appendix V and W for the CONSORT checklist and diagram.

5.3.1 Sample Recruitment

Participants were females based in the UK aged 23. Exclusion criteria included females who had had a cervical screening before being invited as part of the government's cervical screening programme (i.e., before the age of 24.5), females with a personal history of cervical cancer or hysterectomy procedure, and females who could not read or write in English.

Participants were recruited online via Prolific using filters to specify the target population. These included age (23), sex (female) and area of residence (UK) to meet the eligibility criteria. In total, 909 Prolific participants were eligible for recruitment. Data was collected online through surveys hosted via Qualtrics. The first 250 participants who met the eligibility criteria were randomly allocated to either the control group or the intervention group. Online recruitment was completed between 24th July 2024 to 26th July 2024.

5.3.2 Sample Size

A priori power analysis was used to estimate the required sample size. A study by Waite et al. (2024) also investigated the impact of an infographic on intention to attend cervical screening. However, the large sample size recruited in the Waite et al. (2024) study was beyond the scope and feasibility of this PhD. Therefore, the sample size was targeted towards a smaller-scale pilot study. A Cochrane review (Staley et al., 2021) of interventions to increase cervical screening attendance reported that the average risk ratio for education interventions was 1.35, which equates to a small effect size of d = 0.20. The effect of an intervention on intention is likely to be larger than its effect on behaviour. For example, Webb & Sheeran (2006) reported that interventions that had a medium-sized effect on intention (d = 0.66) only had a small effect (d = 0.36) on behaviour. Therefore, an intervention having an effect of d = 0.20 on behaviour would be expected to have an effect of d = 0.37 on intention. The a priori power analysis indicated that at least 232 participants (116 per group) would

need to be recruited to detect an effect size of d = 0.37, with alpha = 0.05 and power = 0.80. Recruiting 250 participants (125 per condition) will allow for some dropouts due to incomplete data.

5.3.3 Measures

5.3.3.1 Pre-Intervention Questionnaire

The pre-intervention questionnaire collected demographic information, including education ("What is the highest degree or level of education you have completed?"), relationship status ("What is your current relationship status?") and HPV vaccination status ("Have you had the HPV vaccine?"). The questionnaire also included a self-rated health question and identification of any long-standing illness, disability, or infirmity (Bowling, 2005; Manor et al., 2001). Other participant demographic data were collected via Prolific, including age, sex, current country of residence, and employment status. This information was only available from Prolific users who had consented to Prolific sharing demographic data. The pre-intervention questionnaire also included screening questions based on the eligibility criteria (e.g., "Have you ever been diagnosed with cervical cancer, had a hysterectomy procedure and/or had a positive pap smear result (if applicable)?"). A single intention strength item (i.e., "I intend to attend cervical cancer screening when I am invited") was included in the pre-intervention questionnaire as a baseline measure (11-point scale; -5 Strongly Disagree to 5 Strongly Agree). Responses on Prolific were manually checked by the researcher and rejected if screening responses were not in line with the eligibility criteria (See Appendix X).

5.3.3.2 Intervention and Control Infographics

Intervention infographic. The intervention infographic (See Figure 5.1 & Appendix Y for larger print) was developed using the COM-B model of behavioural change and the

‘Theory and Techniques’ BCT tool (Human Behaviour Change Project, 2024). The ‘Theory and Techniques’ BCT tool is an interactive resource providing information about the links potential between the mechanisms of action (MoAs) of intention and motivation and specific behaviour change techniques (BCT). Several key BCTs that could be used to target intention and motivation were identified using the ‘Theory and Techniques’ BCT tool and from previous research conducted by the authors (Shpendi et al., 2025b; Shpendi et al., 2024), including health consequences of attending screening, highlighting the importance of attending screening, goal setting and positive reinforcement. More specifically, health consequences were addressed in the first and second sections of the intervention infographic by highlighting the preventability of CC and risk reduction from attending screening. Positive reinforcement was addressed by including the benefits of attending screening, both in statistical risk reduction of developing CC but also personal reassurance of health. Furthermore, to promote goal-setting behaviours, a clear and visual timeline of the key steps of cervical screening in the NHS was included. This included four steps, beginning with receiving a screening invitation to receiving screening results. This would provide participants with key information on the steps to attending cervical screening and also a specific, measurable roadmap to follow. Our previous work also informed key terms and statistics used in the infographic, as well as the tone of the message. For example, our previous research highlighted that it was important to emphasise the “importance” of screening and positively frame statistics about HPV immunisation. Multiple drafts of the infographic were piloted on the target population in five one-to-one informal interviews to obtain feedback to increase the acceptability of the infographic design. Stakeholders were five females aged 23 years old living in the Sheffield area who had not attended cervical screening previously. Stakeholders were recruited via a designated printed advert and word of

mouth around the university campus. Participants were given £5 Amazon vouchers as a thank-you for their participation.

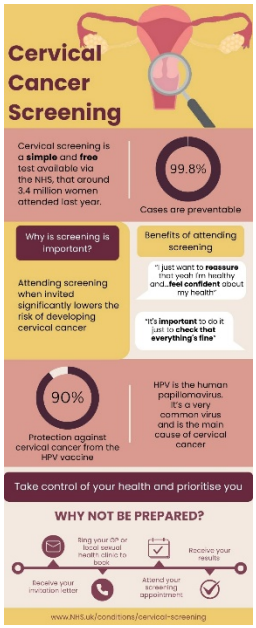

Figure 5.1 Intervention Infographic

Control infographic. The control infographic (see Figure 5.2 & Appendix Z for larger print) was designed using information from the NHS cervical screening website page (NHS, 2023). The introductory statement at the head of the page was copied to allow for minimal and neutral information about screening. The infographic was simple in design, with a white background and black writing. The inclusion of a control infographic presented participants with basic factual content about cervical screening without incorporating the theory-driven BCTs included in the intervention infographic. Therefore, the inclusion of control infographic allowed for the isolation of the theory-driven design elements by controlling for non-specific intervention factors, as well as verifying if changes in intention or motivation were attributable to the targeted BCTs and MoAs in the intervention infographic.

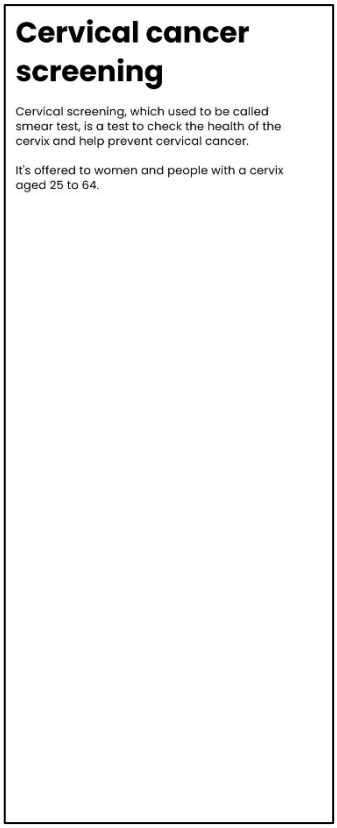

Figure 5.2 Control Infographic

5.3.3.3 Post-Intervention Questionnaire

Intention strength was measured as the primary outcome (Cooke & Sheeran, 2013; Keyworth et al., 2020) using three items, rated on an 11-point scale between 'Strongly Disagree' (-5) and 'Strongly Agree' (+5) (i.e., "I intend to attend cervical cancer screening when I am invited", "I intend to attend my cervical cancer screening every time I am invited." and "I will try to attend my cervical cancer screening when I am invited"). An average score for intention strength was provided for each participant by calculating a mean response score across all intention strength items.

Reflective motivation was assessed using adapted items from Keyworth et al. (2020) and key findings from a previous quantitative analysis (Shpendi et al., 2025). The questionnaire included seven items assessing COM-B beliefs targeted in the infographic (e.g., 'Cervical screening is important') plus an additional general item assessing reflective

motivation (‘I am motivated to attend cervical cancer screening.’) Each statement was rated on an 11-point scale ranging between ‘Strongly Disagree’ and ‘Strongly Agree’. A short description of reflective motivation was provided alongside the first item in the reflective motivation section. An average score for reflective motivation was provided for each participant by calculating a mean response score across all reflective motivation items.

Engagement with the infographic was assessed for both conditions using 8 items adapted from the Attitude Towards the Ad Scale used by Comello et al. (2016) and Waite et al. (2023) (e.g., “How unengaging or engaging did you find the information about cervical cancer screening?” and “How uninformative or informative did you find the information about cervical cancer screening?”. Items were rated on an 11-point scale (-5 to 5). An additional item by Dillard et al. (2007) was also included in the engagement measure, in the same format as the other engagement items (i.e., ‘How ineffective or effective was the information about cervical cancer screening?’). Each participant's average engagement score was calculated as a mean response score across the seven 11-point scale engagement items. Cronbach’s alpha for the scale for these items was .85. The *amount read* was also included as an additional item to measure how much of the infographic was read by participants, measured using a sliding scale from 0 to 100 (e.g., “How much of the infographic did you read?”). The *time* spent viewing the infographics was automatically recorded in Qualtrics in seconds. (see Appendix AA for full questionnaire).

5.3.4 Analysis

SPSS (version 29) was used for statistical analysis. Descriptive analyses were used to describe sample characteristics. Participants in the two conditions (intervention vs control) were compared on their demographic characteristics using chi-square and independent t-tests as appropriate.

The effect of the intervention infographic on post-intervention intention, reflective motivation and engagement was analysed using a series of ANCOVA analyses with condition as the independent variable and pre-intervention intention as a covariate. Demographic variables that reached a *p*-value of <.05 were also controlled for in the ANCOVA analyses. Statistical significance was observed at $p < .05$. A moderated regression analysis was also conducted to examine whether pre-intervention intention scores moderated the effect of the intervention infographic on post-intervention intention scores.

5.4 Results

5.4.1 Participant Characteristics

In total, 251 participants aged 23 years old were recruited, comprising 126 control participants and 125 intervention participants. The majority of participants identified as female (96%), white (68%), and had attended higher education (79%). Most participants were HPV vaccinated (82%), with 56.6% reporting having received two or more doses. Full demographic details are provided in Appendix BB.

Table 5.1 Summary of ANCOVA analysis

Variable	**Intervention**	**Control**	**F**	***p***
	Estimated Mean (SE)	**Estimated Mean (SE)**		
Intention Strength	3.73 (0.09)	3.85 (0.09)	0.82	.367

Reflective Motivation	3.31 (0.08)	3.33 (0.08)	0.021	.886
Engagement	2.78 (0.18)	0.83 (0.18)	57.67	<.001***

Note. ANCOVA analyses controlled for pre-intervention intention scores and number of HPV vaccination doses. SE = Standard Error. *** p < .001.

Table 5.2 Average Time spent on the infographic

Variable	**Intervention**	**Control**
	Mean (SD)	**Mean (SD)**
Page submit	30.72 (39.52)	12.10 (8.61)

Table 5.3 Average amount of infographic read in seconds (engagement item)

Variable	**Intervention**	**Control**
	Mean (SD)	**Mean (SD)**
Amount of infographic read	91.41 (15.63)	91.61 (17.30)

5.4.2 Post-Intervention Measures

One-way ANCOVA analyses were conducted to compare the effect of the cervical screening infographic on intention strength, reflective motivation and engagement whilst controlling for pre-intention to attend screening and the number of vaccine doses (see Table 5.1). Levene's test and normality checks were carried out, and the assumptions were met. There was no significant difference in mean intention strength, $F(1,248) = 0.82$, $p = .367$, or reflective motivation, $F(1,248) = 0.021$, $p = .886$, between the control and intervention infographics. However, there was a significant difference in mean engagement scores between the infographics, $F(1,248) = 57.67$, $p < .001$. Comparing the marginal means, the reported engagement with the intervention infographic mean was higher (M = 2.78, SE = 0.18) compared to engagement with the control infographic (M = 0.83, SE = 0.18). The average time spent on the infographic was also higher (M = 30.72, SD = 39.52) compared to the control infographic (M = 12.10, SD = 8.61), $F(1,248) = 57.67$, $p = <.001$. However, participants in the intervention group (M = 91.41, SD = 15.63) and the control group (M = 91.61, SD = 17.30) on average read a similar amount of the infographics (See Tables 5.2 & 5.3).

5.4.3 Moderation Regression Analysis

Given the high pre-intervention intention mean scores, the non-significant effect of the intervention infographic on post-intervention intentions could be due to a ceiling effect. We, therefore, tested whether the intervention infographic was more effective among those with weaker pre-intervention intentions to attend.

The moderating effect of pre-intervention intention on the effect of the intervention infographic on post-intervention intentions was tested using the PROCESS Macro in SPSS. Condition was entered as the independent variable, along with pre-intervention intention as

the moderator and post-intervention intention as the dependent variable. The pre-intervention intention score did not significantly moderate the effect of the intervention infographic on post-intervention intention scores, B = -0.09, SE = 0.05, p = .058, although simple slopes analyses provided some indication that the infographic had a stronger effect on low levels of pre-intervention intentions (i.e., 1 SD below the mean), B = 0.28, SE = 0.15, p = .057, than at mean, B = 0.08, SE = 0.10, p = .41, and high levels (i.e., 1 SD above the mean), B = -0.05, SE = 0.12, p = .696, of pre-intervention intention. Inspection of the Johnson-Neyman output indicated that the effect of the intervention infographic on post-intervention intentions becomes significant when pre-intervention intention scores are at least 2.75 points below the mean. This equates to a pre-intervention intention score of 0.76.

5.5 Discussion

The present study investigated the effect of a cervical screening infographic on intention, reflective motivation and engagement compared to a control infographic in a sample of young females (who were due to be invited within the next six to 12 months as part of the NHS cervical screening programme). Viewing an infographic about cervical screening by first-time screeners did not change their intention or reflective motivation to attend cervical screening, although it did significantly increase engagement with the information, compared to a control infographic.

The intervention infographic was found to have a non-significant effect on young females' intentions to attend cervical screening. This is contrary to findings by Waite et al. (2023), who found a small significant difference in intention between a generic cervical cancer infographic and an unrelated control infographic in an older sample of females. It is possible that the non-significant results in the present study were due to ceiling effects as pre-intervention intentions to attend screening were already very high (M = 3.51 on a -5 to +5

scale). The moderated regression analysis indicated a negative interaction effect between the intervention and pre-intervention scores that approached significance. Simple slope analyses indicated that the effect of the infographic on post-intervention intentions became stronger as pre-intervention intention scores decreased, such that the effect of intervention became significant when baseline intentions were neutral or negative (i.e., below 0.76). Therefore, these findings give some indication that infographics may be more effective in increasing screening attendance in those with weak or negative intentions to attend. Current figures show that the lowest attendance at first screening is observed in groups who are aged between 25 and 29 years old, particularly those from areas of higher deprivation and ethnic minority backgrounds (Lim & Sasieni, 2015). Future research might selectively target these groups who would be most at risk of non-attendance.

The infographic was theoretically driven and included behaviour change techniques (BCTs) to target reflective motivational components. For example, it utilised BCTs such as pros and cons, emphasising self-incentives through educational material and action planning to motivate cervical screening attendance. However, the infographic did not significantly increase reflective motivation for attending cervical screening. This is contrary to previous research, which has found theory-based interventions to be more effective at promoting health-protective behaviours than non-theory-based interventions (Chanzu et al., 2023; Webb et al., 2010). Nonetheless, the non-significant effect on reflective motivation might also be due to a ceiling effect. Encouragingly, the intervention infographic was significantly more engaging than the control infographic, suggesting that presenting health information in this way to patients is an effective method of engagement, which is an important prerequisite for an intervention's effectiveness (Yardley et al., 2016). Participants reported reading similar amounts of both infographics regardless of control or intervention, highlighting that even though the intervention infographic had a greater amount of information to digest,

participants stayed engaged with the information. This corresponds with previous findings that presenting health data in an infographic helped participants engage more with the data and motivate action towards relevant health issues (Arcia et al., 2016). A successful infographic can be measured in many ways; however, there is a consensus that health infographics should engage audiences and present the information in a comprehensible manner without requiring an explanation from health professionals. In the present study, drafts of the infographic were presented to the target sample to obtain feedback in order to increase its acceptability and clarity. This could also be effectively utilised by co-developing infographics for at-risk groups (Yardley et al., 2016). Our findings align with suggestions made by Waite et al. (2023), which point to a lack of evidence regarding the effectiveness of infographics on cervical screening attendance, although presenting health data in this way has previously been found to be engaging (Arcia et al., 2016). Thus, current research on the impact of infographics in improving screening uptake remains inconclusive.

5.5.1 Strengths and Limitations

The current study had several strengths. First, the infographic was designed based on previous qualitative (Shpendi et al., 2024) and quantitative work (Shpendi et al., 2025b), as well as using the COM-B model of behaviour change and the 'Theory and Techniques' BCT tool. Using previously reported significant associations between reflective motivational components and cervical screening attendance, potential links between specific behaviour change techniques (BCTs) and the mechanisms of action (MoAs) of intention and motivation with behaviour change techniques (BCT) were identified and implemented into the infographic. Second, the use of the online platform 'Prolific' ensures a wide reach of participants for recruitment across the UK. Pre-screening filters also allowed for accurate recruitment of the desired population, particularly regarding age and screening status.

However, this method also has limitations, as those most interested in cervical screening and with positive intentions may be more likely to take part. High initial intention scores resulted in ceiling effects, which are likely to have dampened the effect of the infographic on screening intentions, as well as on reflective motivations. Indeed, there was some evidence that the infographic would be effective for those with neutral or negative initial intentions. For example, ethnic minorities and those of lower socioeconomic status have lower screening attendance rates (Wearn & Shepherd, 2022). Furthermore, like the Waite et al. (2023) study, the current study focused on intention rather than attendance behaviour. Previous work has reported that strong intentions do not always translate into behaviour (i.e. the intention-behaviour gap) (McEachan et al., 2011). Likewise, Webb and Sheeran (2006) demonstrated that interventions that produce medium-sized effects on intentions only lead to small effects on behaviour. A further limitation was the sample size. This limits the power and claims that could be made from the findings of this study and means that the study findings should be treated as a pilot study. Furthermore, there were also limitations in the development of the infographics. A key limitation of the control infographic was an overall lack of matching for the quantity of text and colour when compared to the intervention infographic. Although this was kept plain and simple to better represent the NHS cervical screening website, a visual theme that better matched the intervention may have yielded a stronger comparison for the intervention infographic. Further, neither the intervention infographic nor the control infographic was piloted on the chosen study population before the study, and only minimal patient and public involvement was included in the development of the study materials. Although stakeholder feedback was included in finalising the intervention infographic, more patient and public involvement (PPI) could have been made in the development of the infographic and study materials. For example, errors in the infographic titling (‘cervical

cancer screening' not 'cervical screening') may have been recognised through more extensive feedback and PPI involvement.

5.6 Conclusion

The intervention infographic significantly increased engagement compared to the control group. While no significant difference was found in intention to screen and reflective motivations towards cervical screening, the further analysis highlighted that the infographic may be effective among those with neutral or negative initial intentions to attend cervical screening. Future research should, therefore, target those with low intention to screen.

Chapter 6 General Discussion

Cervical screening rates in the United Kingdom (UK) remain below the government-set targets of 80% coverage of those eligible (NHS England, 2023), with some of the lowest screening rates found in young females (NHS Digital, 2021). Although the HPV vaccination has been proven highly effective in reducing cancer rates (Falcaro et al., 2021), the impact of this on cervical screening uptake is unclear. Furthermore, the vaccine is not 100% protective from CC, and therefore, given that CC can be asymptomatic in the early stages, cervical screening is still key for early cancer detection and diagnosis. Previous interventions to improve cervical screening uptake have demonstrated variable findings and have often not been theory-driven in design and implementation. As a result, a clear gap in the literature was identified regarding the application of behavioural theory to enhance the understanding of cervical screening in young females and to develop and inform evidence-based interventions.

This PhD set out to understand cervical screening behaviours in young females by answering the following research questions:

1) What are the current barriers and facilitators to cervical screening in the UK?

2) What factors are associated with attending cervical screening in the UK?

5. What impact does the HPV vaccination have on decision-making to attend cervical screening in the UK?

3) Do infographics as part of a behaviour change intervention improve intention to attend cervical screening?

6.1 Summary of Thesis Findings

This thesis sought to explore the factors associated with cervical screening in young women in the UK. It utilised the COM-B model of behaviour change as a theoretical framework to guide methodology, analysis and interpretation throughout. The thesis comprised a systematic review, qualitative study, cross-sectional survey study and a randomised controlled trial to develop an intervention that could be used to promote first-time screening attendance in young women.

The systematic review discussed in Chapter 2 highlighted the barriers, facilitators and factors associated with cervical screening attendance in women aged 30 years or under. A narrative review of 106 articles was conducted. Financial constraints, embarrassment and low accessibility were identified as key barriers to screening in this age group. Knowledge about cervical cancer, healthcare providers recommending screening and communication with friends were the most prominent facilitators of attendance. Being older, married and sexually active were significantly associated with having attended cervical screening. Studies also highlighted that being HPV vaccinated was positively associated with having attended a cervical screening, meaning that those vaccinated were more likely to have also attended screening than those not vaccinated. The components of the COM-B model of behaviour change were found to map onto the barriers, facilitators and factors associated with screening, identified in the systematic review.

The utility of the COM-B was further demonstrated in the two-stage reflexive thematic analysis conducted on qualitative interviews exploring young women's views on cervical screening (Chapter 3). Six themes were identified and mapped onto three COM-B components, along with one unique theme that emerged from interviews with attendees and non-attendees. Social opportunities, such as a level of openness about screening with friends

and family, were a key difference between groups, whereby attendees reported being open about screening with family and friends, and non-attendees reported not discussing such topics with those around them and not being aware of anyone who had attended cervical screening. Also, psychological capability varied, with attendees reporting more knowledge about screening and the procedure, whereas non-attendees expressed more age-related misconceptions about when screening is appropriate/needed. In both groups, reflective motivations were a key facilitator for attending screening (e.g., reassurance and importance of screening), whereas automatic motivation, such as embarrassment, was a barrier for both groups. Finally, HPV vaccination status did not appear to play a role in the decision-making of screening attendance; however, information regarding the effectiveness of the HPV vaccine was positively received.

Findings from the systematic review and qualitative study informed the design of the cross-sectional survey study (Chapter 4), which examined the association of COM-B components and HPV vaccination status with cervical screening attendance in a sample of 200 young women and people with a cervix. All five of the COM-B components (Psychological Capacity, Social Opportunity, Physical Opportunity, Reflective Motivation, Automatic Motivation) analysed were significant in the univariate analyses, however, reflective motivation was identified as the only significant predictor of screening attendance in a multivariate logistic regression analysis.

These findings suggested that cervical screening attendance is significantly influenced by intention to attend and beliefs about cervical screening. The strongest demographic factors predicting screening attendance were being employed, white ethnicity and being partnered. In contrast, being religious or having a longstanding illness or disability decreased the likelihood of utilising cervical screening. Additionally, it was found that those who had received the HPV vaccine were more likely to have attended screening than those who had

not been vaccinated, corresponding with the findings from previous literature reported in the systematic review (Chapter 2). This, alongside the reports from participants who positively received information about the HPV vaccination, found in the qualitative study (Chapter 3), provides a clearer understanding of the possible impact of the HPV vaccine on current young females in the UK.

The final study (Chapter 5) tested an infographic intervention targeting reflective motivational factors in cervical screening developed from Chapters 2 and 3. The outcome was cervical screening intentions. The intention or motivation to attend cervical screening did not significantly improve in the intervention group compared to the control group. It is possible the intervention infographic was not effective due to ceiling effects (i.e., high baseline intentions to attend the screening). There was some evidence to suggest that the infographic would be useful for those with neutral or negative baseline intentions to attend cervical screening.

6.2 Theoretical Implications

As highlighted throughout this thesis, previous work had not consistently applied a theoretical framework to understand the factors associated with cervical screening in young women. As outlined in Chapter 1, the COM-B model was used as an overarching theoretical framework throughout the thesis. Part of the rationale for choosing the COM-B model was the applicability and flexibility of the COM-B to inform the design of qualitative, cross-sectional and experimental studies, as well as for the interpretation of research findings. In particular, this thesis, the COM-B model was used to conceptualise the barriers, facilitators and factors associated with screening attendance (Chapters 2, 3 & 4) and then to inform the development of the infographic intervention (Chapter 5) using behaviour change techniques

(BCTs) to target reflective motivations. The findings of this PhD suggest that reflective motivational components are key factors associated with screening attendance. For example, key facilitators among young women in the UK were a belief that cervical screening is "important" and the reassurance that attending cervical screening can have on health status. The significance of reflective motivations is also consistent with other models of health behaviour, such as the theory of planned behaviour (Ajzen, 1991) and protection motivation theory (Boer & Seydel, 1996), that highlight intention (or protection motivation) as a proximal determinant of behaviours. This also provides clear guidance for intervention development and targeted factors when informing or promoting cervical screening in young women.

The thesis findings also provide clarity on the current barriers, facilitators, and factors associated with cervical screening in young women. In particular, Chapter 2 presents a comprehensive and novel narrative review of 106 papers, identifying key barriers, facilitators, and factors associated with cervical screening of young women globally. This provides an up-to-date understanding of the current literature and synthesises a breadth of evidence. Previous reviews had not focused on an under-30-year-old age range and had not focused specifically on early screening experiences. In this review, we were also able to introduce a theoretical framework to further conceptualise and validate barriers and facilitators to cervical screening. This provides a novel way of understanding cervical screening attendance behaviours, further advancing current understanding and literature. Chapters 3 and 4 focused on barriers and facilitators relative to a UK-based population. Similar to the broader trends identified in the systematic review, the qualitative interviews highlighted in Chapter 3 aligned with the systematic review findings of key facilitators. For example, social opportunities and psychological capabilities were key facilitators reported globally in the systematic review and also in the UK-based qualitative study. Notably, physical opportunities were a key barrier in

the systematic review but were not as commonly reported in the UK sample (Chapters 3 & 4). Differences in physical opportunities were likely due to differences in screening availability and a lack of organised screening programmes in many parts of the world; however, given the NHS cervical screening programme and availability of free cervical screening in the UK, it is understandable that physical opportunity would be a less prominent barrier. These similarities and differences between Chapters further validate key barriers and facilitators of cervical screening and explain the differences from a global perspective and a UK-centric perspective.

The prevalence of automatic motivations, such as embarrassment and fear of pain, was consistent in previous literature (Chapter 2) and the UK-based qualitative study (Chapter 3). Automatic motivations are often emotional responses that can influence behaviour without conscious deliberation. Automatic motivations were interestingly reported in the qualitative study by both attendees and non-attendees. However, despite the prevalence of these barriers, automatic motivations did not emerge as a significant predictor of screening attendance (Chapter 4). Therefore, the role of these negative emotions highlights the complexity of behaviour, and despite their non-significant predictive power, these automatic motivations remain important barriers to address in interventions aimed at improving screening uptake. Previous research has highlighted that people will often explain their behaviours based on implicit theories about what factors should logically influence their actions and often lack awareness of the cognitive processes that influence their behaviour (Nisbett & Wilson, 1977). This was further discussed by Waller et al. (2009) concerning cervical screening, highlighting that it is common to see similar explanations and emotions shared, therefore, embarrassment is often a key barrier and emotion reported about cervical screening from both attendees and non-attendees. Likely, young females are not aware of the true impact of emotions like fear or embarrassment can have when deciding to attend cervical screening. Although the COM-B

considers emotions a driver for behaviour under automatic motivations, it may not consider the nuanced interplay of emotions. Additionally, dual-process theory could build on this further by examining how both intuitive (System 1) and deliberative (System 2) thinking processes influence behaviour, further highlighting the importance of automatic motivations in decision-making (De Neys, 2006; Wason & Evans, 1974).

Furthermore, reflective motivational components were consistently evident throughout all three chapters (Chapters 2, 3 & 4). Specifically, reflective motivations were a key facilitator reported in the qualitative study (Chapter 3) and the only significant factor associated with screening attendance in the cross-sectional survey study (Chapter 4). As previously mentioned, these findings align well with other theoretical models. For example, the self-determination theory (SDT) (Deci & Ryan, 2012) suggests that humans have an innate tendency toward growth and fulfilment fuelled by autonomy, competence and relatedness. Reflective motivations involve conscious decision-making based on personal values and goals. Therefore, suggesting that young women will reflect on the benefits of screening and integrate this into their individual goals, whilst creating a sense of ownership over their decision to attend cervical screening. This consistency across different Chapters and methodologies (qualitative and quantitative) strengthens this argument that reflective motivations are not just reported experiences but also statistically significant predictors of behaviour.

Overall, the COM-B model of behaviour change has provided a strong theoretical framework throughout this thesis, which aligned well with a range of methodologies. The COM-B model served well as a guiding framework underpinning every stage of the research and intervention development. However, it is also important to note that while the COM-B model includes physical capability, this was not a component identified when exploring barriers and facilitators to cervical screening and therefore was not measured. Physical

capability could, however, be important in other populations where physical limitations may impact cervical screening attendance. Furthermore, interventions such as self-sampling may also need to consider physical capabilities in the intervention design and implementation.

6.3 Practical Implications

There are several practical implications that can be drawn from the findings presented in this thesis. Firstly, given the nature of the NHS cervical screening programme invitation protocol, making changes to target young women and first-time screening could be achieved via the NHS system by filtering for the age of the recipient. Therefore, interventions such as infographics, which can easily be in printed or digital formats, remain a low-cost and engaging format for promoting screening amongst young women. An infographic could be integrated to support the invitation protocol via either print form alongside or replacement of the invitation letter, or digitally via the NHS social media and app/online platforms for larger scalability. The increasing use of infographics has been evident in the NHS when promoting other health behaviours such as physical activity (Children's Health GOV.UK, 2023) and a healthy working environment/routine (NHS Employers, 2024), however, it is unclear whether the content in NHS infographics is research or theory based. As the implementation of infographics for cervical screening behaviours is in the early stages, the work in the thesis could be used as a model of how integrating theory could work when promoting cervical screening behaviours.

Recommendations made in Chapter 5 provide clear guidance for future research on infographics targeting young women and first-time screening attendance. However, targeting those with neutral or negative initial intentions to attend cervical screening may be more helpful in improving the effectiveness of an infographic intervention. In practice, indications

of intention to attend screening would be difficult to understand at the first cervical screening invitation. Therefore, sending an infographic to those who fail to attend the first screening could be one way to address this. However, given that this group may be difficult to target, sending an infographic with all first screening invitations may be a viable option. The infographic did not significantly reduce intentions or motivations to attend cervical screening and would therefore not negatively impact those with intentions to attend cervical screening.

Furthermore, infographics could also be adapted and utilised as the NHS cervical screening programme develops. For example, in the context of the current plans to offer self-sampling to long-term non-attendees (NHS, 2025), infographics could be a feasible method to support its introduction. As identified in Chapter 5, infographics can be a significantly engaging way to present health information, as well as easily adaptable. In the context of self-sampling, reflective motivational content could be adapted to provide not only instructions on how to use a self-sampling kit but also promote the benefits of self-sampling. Additionally, this is also relevant to more recent changes in intervals of routine cervical screening. Extended intervals mean that those who test negative for HPV will be invited for screening every five years, as opposed to previously three (Hylton Medical Group, 2025). Reflective motivation content could be used in support of these changes, but positively framing the extended intervals, alongside key information, when promoting first-time screening.

Further, as identified in Chapter 4, it is evident that not all those of eligible screening age are receiving invitations to attend cervical screening (although it is important to note that self-reporting errors can also occur, and some young women may have forgotten receiving an invitation). Regardless, these individuals still have access to screening, and research shows that receiving invitations is a significant predictor of screening attendance (Staley et al., 2021). This subgroup may experience unique barriers and experiences to accessing cervical screening that are different to those experienced by most young women invited to cervical

screening. As noted in Chapter 4, not receiving a cervical screening invitation from your local GP can occur for multiple reasons, such as frequently moving home and not updating current addresses, and evidence has also highlighted structural errors and inefficiencies within the NHS that can result in delayed or missed invitations. The majority of participants who had not received a screening invitation in the cross-sectional study were also non-attendees. This reinforces previous findings that receiving an invitation is a vital facilitator and predictor of screening attendance and highlights the critical role of the invitation process. One way to combat this is through educating females of screening age or younger about the invitation protocol. This was one aim of the infographic developed in this thesis, in which goal setting BCTs were used to provide a simple and visual timeline of the screening process, including when to expect an invitation letter. In this research, some of those who had not received a cervical screening invitation had attended cervical screening, which serves to highlight that reflective motivations, specifically conscious decision-making, are likely to be more proximal determinants of cervical screening attendance.

Moreover, the planned launch and introduction of the 'Ping and Book' service in the NHS app will likely further enhance the cervical screening invitation process and reduce the chances of missing an invitation. The 'ping and book' functionality will enable eligible participants to book cervical screening through the NHS app (Healthwatch, 2024), aiming to fully digitalise cervical screening. Under new plans, eligible participants will first receive a reminder notification in the NHS app to book a cervical screening appointment, followed by an email or text message if they do not respond to the notification. Finally, a letter will be sent by post if all previous reminders do not result in an appointment booking. Therefore, expanding the cervical screening invitation process to include various media and reminders will also directly address the practical barrier of missed invitations identified in Chapter 4. Moreover, the multi-layered reminder system will likely reinforce the importance of

screening to young women and people with a cervix through multiple reminders, as well as an opportunity to reinforce reflective motivations via the content featured in the reminders.

The positive/reinforcing impact of the HPV vaccine is currently underemphasised in efforts to improve cervical screening uptake. As found in the qualitative study (Chapter 3) young women feel positive towards the HPV vaccine and its effectiveness; and this is reflected in the increased odds of attending screening attendance, both globally, as found in the systematic review (Chapter 2), and in the UK, as found in the qualitative (Chapter 3) cross-sectional studies (Chapter 4). However, a gap remains in young women's awareness of the link between being HPV vaccinated and cervical cancer. Currently, the HPV immunisation programme and NHS cervical screening programmes are promoted separately, and therefore, the link between HPV and cervical cancer is not always clear to the public. Another aim of the infographic intervention was to include accurate information about the HPV vaccine and its effectiveness against cervical cancer. Future research could incorporate HPV immunisation information into educational interventions for improving understanding and cervical screening uptake in young women. Similarly, unvaccinated women are also less likely to attend screening compared to vaccinated women. This remains particularly relevant within the context of future cervical screening cohorts, highlighted by the influence of the widespread rollout of the HPV vaccination. Previous research has addressed the impact of the HPV vaccine by providing crucial evidence base for future policy changes (Landy et al., 2017). The modelling work demonstrates that, for women vaccinated against HPV16/18, only three lifetime screens are needed to achieve a cancer prevention rate similar to that achieved by seven screens in unvaccinated women. These findings further support the notion that although vaccination will not replace screening, it does fundamentally change the screening needs of future cohorts. As well as previously mentioned, a need for the NHS to adapt

communication and invitation strategies to reflect these changes and the opportunity for future educational interventions to target this information for a majority vaccinated group.

As the HPV immunisation programme continues to expand and work towards a 90% vaccination coverage target set by WHO (Arbyn et al., 2021), cervical high-risk subgroup of non-vaccinated young women remains. Non-vaccination can stem from a range of different factors, including vaccine hesitancy, which may be influenced by complex cognitive processes that are not always consciously understood or easily changed through education alone (Jarrett et al., 2015; Perrone et al., 2023). Given that the vaccination is 90% effective, efforts to prioritise cervical screening need to continue, whilst effective long-term strategies are developed to improve vaccine acceptance. This approach will serve to acknowledge both the importance of early detection and prevention, alongside the reality of existing vulnerabilities in non-vaccinated groups.

However, despite the association between positive vaccine status and screening attendance, and the opportunities to utilise this, the qualitative findings in chapter 3 highlighted that knowledge of the HPV vaccine and the link to cervical screening was low and did not appear to be a conscious driver of the decision-making process for attending screening. This seemingly suggests that the link between vaccination and screening is likely not one of direct, conscious deliberation. For example, the very act of being vaccinated may serve as an early, positive health-seeking behaviour. Young women who receive the vaccine may be more generally proactive about their health and thus more likely to engage with other preventative health services, like cervical screening, when they become eligible. This would mean that the correlation is not a direct result of understanding the link between HPV and cancer prevention but rather an association with a broader preventative health mindset, which could be seen as an additional reflective motivation.

6.4 Strengths and Limitations

This thesis had several strengths with regard to the methodology and approaches used to investigate cervical screening attendance in young women. First, a range of methods and analytical approaches were adopted to investigate cervical screening attendance in young women, including a systematic review, qualitative analysis and regression analyses. This range of analytical approaches allowed for a more comprehensive understanding of the topic whilst balancing out the limitations of individual research methods. The use of numerical data and in-depth interviews allowed for a more complete understanding of the barriers and facilitators of cervical screening. This thesis drew on various methodologies to investigate and analyse a single issue, and key findings remained consistent across different studies, strengthening the conclusions made.

Second, the adoption of a well-established and relevant theoretical framework was a key strength of this thesis, advancing the understanding of cervical screening from a theoretical perspective. The COM-B was identified in Chapter 2 and then embedded into the research methodology and analysis for all consecutive chapters. The use of a theoretical framework allows for a basis for understanding the determinants of behaviour and further informs how best to approach behaviour change (Connor & Norman, 2015). A final strength is that the infographic in Chapter 5 was developed using feedback from the target sample, allowing for a more collaborative effort and strengthening the acceptability of the infographic intervention. Adopting a person-based approach in intervention development allows for the understanding of young women's perspectives and psychosocial context, which can be particularly beneficial in online interventions, where the perspectives and needs of the users can be implemented to ensure engagement and acceptability (Yardley et al., 2015).

However, there were also a number of limitations across the studies in this thesis. First, and most importantly, self-reported screening attendance was assessed rather than actual screening attendance. Although intentions have been proven to be better able to predict self-report than observed behaviour (McEachan et al., 2011), future work could review the impact of an infographic intervention on observed screening behaviour as a follow-up. Research in cervical screening is difficult to conduct in a clinical setting, and access to NHS medical records was not available under the ethical clearance to cross-reference reports of screening attendance. Therefore, self-reporting of screening attendance was the most practical method available for the research in this thesis. Further, given the unique nature of the procedure, participants are likely to have a clear memory of whether or not they have attended cervical screening.

A second, although the COM-B model of behaviour change was implemented across all chapters, this thesis did not include physical capability. As previously mentioned, this was due to physical capability not being a prominent reported barrier in the UK-based population in Chapter 3. However, this highlights a potential limitation in the generalizability of these findings to other contexts where physical access and barriers to screening may be more restricted.

Third, as highlighted in Chapter 5, was the likely high baseline intention across all empirical studies. Study effects prominent in the current research likely meant that those who participated were interested in the topic and had some intention to attend cervical screening. This was evident in the findings in Chapter 5, as baseline intention was high in both intervention and control groups. For example, recruitment biases have been shown in previous literature to possibly impact results and generalisability (Benedict et al., 2019; Vaughan-Johnston et al., 2024). However, online recruitment methods remain more time-efficient compared to offline recruitment methods (Christensen et al., 2017).

Fourth, samples recruited throughout this thesis consisted of predominantly white and relatively educated majority samples that do not always reflect ethnic diversity and education levels across the UK. Barriers and facilitators may vary between different population subgroups, which the current studies were unable to fully assess. However, various recruiting mediums were used to try and mitigate these biases, such as Prolific, Gumtree, and Call for Participants. For example, the use of Prolific was the most reliable in Chapters 4 and 5 and was chosen as a known online recruitment platform that allowed for clear specifications to be made for the desired sample (e.g., age restrictions). Demographic differences were also assessed in Chapters 4 and 5 and controlled for in the final analysis where necessary. Furthermore, given the aims of the studies in Chapters 3, 4 and 5, each study was powered accordingly and therefore was not powered for subgroup analysis.

Fifth, the use of Prolific and online methods for study recruitment could have resulted in a recruitment bias across all empirical studies. Particularly evident in Chapter 5, where the baseline intention was high in both the intervention and control groups. Although online recruitment methods can be time-efficient and reach a wider audience, they also have potential biases. For example, Prolific is limited to available participants who are actively signed up to the site, which may attract certain types of participants only, creating a bias. However, online recruitment throughout this thesis research allowed for a broader reach geographically of participants across the United Kingdom. A further limitation of the use of online platforms is the inherent digital exclusion bias, which systematically omits people in the UK living offline (approximately 1.6 million people), which are more likely to include those from the most deprived backgrounds (GOV.UK, 2023). This is particularly significant, as it means groups often excluded from research more generally, such as those from deprived backgrounds and of certain disabilities, remain underrepresented. Further these populations who experience digital poverty are already less likely to attend cervical screening (Badr et al.,

2024; Choolayil et al., 2024) and frequently experience worse health outcomes, higher costs when shopping, and are five times more likely to be unemployed (GOV.UK, 2023).

Sixth, the lack of overall public and patient involvement (PPI) and stakeholder input in the empirical studies. While previous research and literature influenced the development of the study designs and materials, a more comprehensive approach involving stakeholders and piloting throughout the research process could have provided deeper insights and improved the applicability of the findings. For example, the use of the Keyworth (2020) statements in Chapters 4 and 5 provided a framework for the COM-B items. Although the Keyworth (2020) framework provided descriptions for each COM-B component, there is a possibility that this may not have been read by participants, and it is unclear whether these descriptions would have been clearly understood. Therefore, without piloting the study questionnaires, the acceptability and comprehensibility of the items are unclear.

6.5 Directions for Future Research

Future research could build on the findings of this thesis by investigating the impact of an infographic targeted at at-risk subgroups. Specifically, those with negative intentions to attend cervical screening, unvaccinated females and minoritised demographic subgroups. More research is needed to understand non-attendees' behaviour and barriers to cervical screening, particularly among younger non-attendees. An infographic could also be co-designed and revised to target the needs and COM-B components relevant to individual subgroups. Further, gaining an understanding of what COM-B components are most relevant for these subgroups and whether reflective motivations remain a key predictor of screening attendance. Future research could follow up on the effectiveness of an infographic intervention, as well as significant COM-B components, with cervical screening uptake.

Future research could incorporate the HPV vaccination findings and information into future interventions and utilise HPV vaccination as a facilitator to cervical screening attendance. The findings in this thesis highlighted the need for increased awareness of the link between HPV vaccination and cervical cancer. As a large majority of those now attending cervical screening will be HPV vaccinated, this is key information relevant to informing cervical screening decision-making.

6.6 Overall Conclusions

In summary, the body of the research presented in this thesis indicates that reflective motivations are key targets for improving cervical screening attendance in young women and people with a cervix. Specifically, interventions targeting reflective motivations in those with lower initial intentions to attend screening are likely to be effective and increase both screening intentions and behaviour. The HPV vaccine has a positive impact on cervical screening attendance and should be utilised as an additional facilitator for improving screening uptake. More is needed to educate young women and people with a cervix about the links between the HPV vaccine and cervical screening.

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APPENDIX A. Systematic review search strategy

Key words

Hpv

- Human papillomavirus
- Human papilloma virus
- Alphapapillomavirus
- Uteral cervical neoplasms
- Cervical Dysplasia
- Cervical Cancer
- Uterine Cancer

Screening (screen*)

- Pap
- Smear
- Colposcopy
- Papanicolaou

Wom?n

- Female
- Vagina*
- Cervix
- Cervic*

Facilitator (facilitat*)

- Predict*
- Barrier*
- Associat*
- Correlat*
- Influenc*

Factor*

Reason*

Behaviour (Behavio*)

Inten*

Willing*

Attend*

Uptake

Compliance

Comply

Complied

Adhere*

Accept*

Utili?ation

Refus*

Reluct*

Individual search engine search strategies

Scopus

(TITLE-ABS-KEY (hpv OR "human papillomavirus" OR "human papilloma virus" OR alphapapillomavirus OR "uteral cervical neoplasms" OR "cervical dysplasia" OR "cervical cancer" OR "Uterine cancer") AND TITLE-ABS-KEY (screen* OR pap OR smear OR colposcopy OR papanicolaou) AND TITLE-ABS-KEY (wom?n OR female OR vagina* OR cervix OR cervic*) AND TITLE-ABS-KEY (facilitat* OR predict* OR barrier* OR associat* OR correlat* OR influenc* OR factor* OR reason*) AND TITLE-ABS-KEY (behavio* OR inten* OR willing* OR attend* OR uptake OR compliance OR comply OR complied OR adhere* OR accept* OR utili?ation OR refus* OR reluct*))

Web of Science

hpv OR "human papillomavirus" OR "human papilloma virus" OR alphapapillomavirus OR "uteral cervical neoplasms" OR "cervical dysplasia" OR "cervical cancer" OR "Uterine cancer" (Topic) and screen* OR pap OR smear OR colposcopy OR papanicolaou (Topic) and wom?n OR female OR vagina* OR cervix OR cervic* (Topic) and facilitat* OR predict* OR barrier* OR associat* OR correlat* OR influenc* OR factor* OR reason* (Topic) and behavio* OR inten* OR willing* OR attend* OR uptake OR compliance OR comply OR complied OR adhere* OR accept* OR utili?ation OR refus* OR reluct* (Topic)

MEDLINE

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to December 16, 2021>

1 hpv.mp. or exp Papillomavirus Infections/ 60254

2 alphapapillomavirus.mp. or exp Alphapapillomavirus/ 8805

3 exp Uterine Cervical Dysplasia/ or exp Uterine Cervical Neoplasms/ or cervical dysplasia.mp. 81644

4 cervical cancer.mp. 52669

5 screen*.mp. 930441

6 pap smear.mp. or exp Papanicolaou Test/ 8988

7 colposcopy.mp. or exp Colposcopy/ 9696

8 papanicolaou.mp. 10636

9 1 or 2 or 3 or 4135065

10 5 or 6 or 7 or 8942606

11 Female/ 9282190

12 woman.mp. or Women/ 247660

13 cervix.mp. or exp Cervix Uteri/ 70795

14 vagina.mp. or exp Vagina/ 49562

15 cervicovaginal.mp. 2873

16 11 or 12 or 13 or 14 or 15 9335220

17 predict*.mp. 1887622

18	barrier*.mp.	357969
19	associat*.mp.	5099274
20	correlat*.mp.	2052697
21	influenc*.mp.	1620434
22	factor*.mp.	6093151
23	reason*.mp.	479379
24	facilitat*.mp.	607307
25	17 or 18 or 19 or 20 or 21 or 22 or 23 or 24	12643674
26	behavio*.mp.	1831066
27	inten*.mp.	1166486
28	willing*.mp.	48795
29	attend*.mp.	201324
30	uptake.mp.	416743
31	compliance.mp.	176782
32	comply.mp.	12207
33	complied.mp.	5119
34	adhere*.mp.	245259
35	accept*.mp.	556315
36	utilisation.mp.	24565
37	utilization.mp.	243476
38	refus*.mp.	64471
39	reluctance.mp.	7270
40	26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39	4420747
41	9 and 10 and 16 and 40	7138

PsychInfo/PsychArticles

APA PsycArticles Full Text

APA PsycInfo <1806 to November Week 5 2021>

1 hpv.mp. or exp Papillomavirus Infections/ 1921

2 alphapapillomavirus.mp. or exp Alphapapillomavirus/ 41

3 exp Uterine Cervical Dysplasia/ or exp Uterine Cervical Neoplasms/ or cervical dysplasia.mp. 89

4 cervical cancer.mp. 2631

5 screen*.mp. 175901

6 pap smear.mp. or exp Papanicolaou Test/ 549

7 colposcopy.mp. or exp Colposcopy/ 147

8 papanicolaou.mp. 694

9 1 or 2 or 3 or 43822

10 5 or 6 or 7 or 8176208

11 Female/ 0

12 woman.mp. or Women/ 125865

13 cervix.mp. or exp Cervix Uteri/ 1438

14 vagina.mp. or exp Vagina/ 1825

15 cervicovaginal.mp. 27

16 11 or 12 or 13 or 14 or 15 128076

17 predict*.mp. 597042

18 barrier*.mp. 99209

19 associat*.mp. 1122399

20 correlat*.mp. 503647

21 influenc*.mp. 651110

22 factor*.mp. 1160729

23 reason*.mp. 280479

24 facilitat*.mp. 237738

25 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 2774232

26 behavio*.mp. 1518426

27	inten*.mp.	385077
28	willing*.mp.	64369
29	attend*.mp.	151821
30	uptake.mp.	30469
31	compliance.mp.	55307
32	comply.mp.	7998
33	complied.mp.	2599
34	adhere*.mp.	59178
35	accept*.mp.	285582
36	utilisation.mp.	3333
37	utilization.mp.	56946
38	refus*.mp.	29088
39	reluctance.mp.	8588
40	26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39	2029057
41	9 and 10 and 16 and 40	742

CINAHL

S24	(S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22) AND (S1 AND S2 AND S3 AND S11 AND S23)	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (1,252) View Details Edit

S23	S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (1,272,037) View Details Edit
S22	reluct*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (6,683) View Details Edit
S21	refus*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (18,981) View Details Edit
S20	utilisation OR utilization	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (258,060) View Details Edit
S19	accept*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (122,181) View Details Edit

S18	adhere*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (75,532) View Details Edit
S17	compliance OR comply OR complied	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (102,363) View Details Edit
S16	uptake	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (47,136) View Details Edit
S15	attend*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (86,362) View Details Edit
S14	willing*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (22,693) View Details Edit

S13	inten*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (311,471) View Details Edit
S12	behavio*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (470,133) View Details Edit
S11	S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (2,834,902) View Details Edit
S10	reason*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (122,799) View Details Edit
S9	factor*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (1,720,525) View Details Edit

S8	influenc*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (300,561) View Details Edit
S7	correlat*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (426,068) View Details Edit
S6	associat*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (1,220,184) View Details Edit
S5	"barrier*"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (105,929) View Details Edit
S4	"facilitat*"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (129,456) View Details Edit

S3	female OR wom#n OR vagina* OR cervix	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (2,247,441) View Details Edit
S2	(MH "Cervical Smears+") OR (MH "Cervical Smears, Automated") OR "screen* OR pap OR smear OR colposcopy OR papanicolaou" OR (MH "Colposcopy")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (7,834) View Details Edit
S1	(MH "Cervix Neoplasms+") OR (MH "Cervical Intraepithelial Neoplasia+") OR (MH "Papillomaviruses") OR "(hpv or human papillomavirus or human papilloma virus) OR alphapapillomavirus OR cervical cancer OR cervical dysplasia OR uteral cervical neoplasms OR uterine cancer"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	

APPENDIX B. Number of participants screened and reported barriers to cervical screening per included study

Reference	Participants screened for CC (n, %)	Barriers (n, %)
Abiodun et al 2014	EXP 15, 4.3%, CON 12, 3.4%	Lack of awareness, Accessibility constraint, Poor quality of health services, Cost, Lack of interest
Abotchie et al 2009	13, 12%	Getting cervical test would only make me worry, If I am destined to get cancer, The purpose of screening is to diagnose if I have cancer or not, Screening is not necessary since there is no cure for cancer, The pap test is painful, It is too expensive to have a pap test, It is embarrassing to have a pap test, If a woman is a virgin, pap test will take away her virginity (16, 11.5%), I don't know where I could go if I wanted a pap test, My partner would not want me to have a pap test, If a young woman goes for pap test everyone will think she is having sex
Ackerson et al 2008	6, NR	Lack of insurance coverage, "Feeling fine"
Ackerson et al 2014	56, 84%	Lack of knowledge, don’t know where to get appointment, Time-consuming, forget to schedule, Other more important problems,
Akpo et al 2016	10, 11.24%	Cost, Embarrassing, Feeling "healthy"

Akujobi et al 2008	0, 0%	Concern of embarrassment of cancer being discovered, Have not heard of it, Do not know where to go for the test, Think it is not necessary, Fear pain and discomfort, Have no time, No reason
Al-Naggar et al 2010	NR, 6%	Pap smear too expensive, Painful, Pap test make me worry, Pap test is embarrassing, Virginity will be taken away if pap test is done to the virgin woman, Do not know where to go if want to have pap smear test, Partner does not allow you to do Pap smear test, Any Health care workers advice you to do the test
Alwahaibi et al 2017	Outpatients NR, 36.8%; Medical Staff NR, 23.3%	Not familiar with/never heard of pap smear, Fearful of pap smear procedures or you had bad experiences when seeing an obstetrician or gynaecologist, Lack privacy, Location for screening is too far, Fearful of dealing with the results, Had no time, Too costly, Not been sexually active for a long period of time, Not married or still young, Ineffective in detecting cervical cancer, Fearful of contracting other diseases, Healthy lifestyle, Religious beliefs / family restrictions, Difficulties to communicate with your gynaecologist, Others
Aniebue et al 2010	10, 5.2%	Absence of symptoms, Did not know where to obtain pap smear
Anikwe et al 2021	NR, NR	No time, Fear of result, Don't know, Procedure is cumbersome, Cost consideration, Not sexually active, Not thought of it, Not aware of any screening centre
Argaw et al 2022	78, 20.3	No time, "I am not sick", More serious issues to worry about, have not heard of screening, Fear of result, Other
Aweke et al 2017	58, 9.9%	Not heard of CC, never had an illness, Disease not serious, not aware of CCS, not available nearby, Other
Ayeni et al 2023	8, 6.9%	Embarrassment, Fear of result, Lack of knowledge, Absence of symptoms, Too expensive, Spouse doesn’t allow it,
Ayinde et al 2004	35, 8.3%	Lack of awareness about the test, Did not know where to have the test, Cost, Just reluctant to have the test, Belief in not being at risk of cancer of the cervix, Belief that the test is not useful, Feeling that the test is cumbersome, among others

Bakogianni et al 2012	NR, 44.82%	Belief no need for the test, Afraid of visiting a gynaecologist, Quite expensive, If have vaccine do not need pap test
Bayu et al 2016	235, 19.8%	Feeling "healthy", Cost, Fear of pain, Time consuming, Embarrassment, Time inconvenient
Bammeke et al 2014	NR, NR	Fear of pain, Lack of knowledge/awareness, Not at risk, Accessibility constraints, Don’t know where to get screening, Difficulty getting an appointment, Cost, Haven’t been advised by healthcare worker, Nurses haven’t mentioned screening, Didn’t feel encouraged
Black et al 2011	NR, NR	Moving away from home and not establishing care with a provider or clinic. Difficulty finding a health-care provider, especially female. Fear and discomfort. Lack of education (why testing is important and what it entails). Fear of finding out something is wrong. Test too invasive. Intimidation and embarrassment. Time required. Not owning a car and living in a rural area. Childcare.
Burak et al 1998	290, 72%	Gynaecological exams were painful or very painful, Embarrassing or very embarrassing, Expensive or very expensive
Cooper et al 2018	NR, NR	Psychological: Self-limiting beliefs, feelings of vulnerability. Physical: "very painful". Time: lack of due to things such as studies, family commitments and wanting to spend time with friends. Location: those who had not didn’t know where and Economic barriers: potential costs. Lack of maternal involvement.
Deresse et al 2018	124, 15.1%	No screening site, Limited information, too far, no health education programmes to promote, Lack of knowledge of the test, Not engaged in sexually risky behaviour, Cultural beliefs, Spouse doesn't allow, Fear of pain, Shyness, Fear of result, don’t know where to get screening, Other
Dhendup et al 2014	34, 6%	Never thought that I needed one, embarrassed to get examined by male health professional, Afraid to find out cancer, Wasn’t aware such services are available in our health facilities, Because of past unpleasant experience with health professionals, Others
Dozie et al 2021	27, 7.2%	Fear of result, Lack of knowledge, Absence of symptoms, Don’t know where to get screening, Cost
Easwaran et al 2023	8, 5.7%	Embarrassment, Fear of pain/discomfort, Lack of knowledge, Absence of symptoms,
Eiser et al 2002	NR, NR	Worry that the test would be painful, Inconvenience of location

Gebisa et al 2022	NR, 6.3%	Embarrassment, Pain, Feeling "healthy", Spousal constraints, Fear of result, Cost, Lack of knowledge, No reason
Gebreegziabher et al 2016	24, 10.4%	Carelessness, Fear of pain, Fear of positive result, Embarrassment, not at risk, Lack of time, Expensive cost, Partner influence, don't where to get screened, don't know availability, Long distance, Lack of trained nurses, Service inaccessible
Gebregziabher et al 2019	NR, 17.2%	Lack of decision to be screened, Painful, Feel shy
Gelassa et al 2023	77, 36%	Embarrassment, Pain, Feeling "healthy", Spousal constraints, Afraid of screening, Lack of knowledge, Cost, No reason
Getaneh et al 2021	2, 0.05%	I am health, It may be painful, I feel shy, not informed about screening place, No interest, partners will not allow, no time, never heard of it
Head et al 2012	17, 89.5%	Cost, Fear of others finding out, Negative perceptions of screening, Lack of privacy
Ibekwe 2015	DELSUTH 9, 9%; UBTH 7, 7%	Fear of having positive results, Cost of service/lack of money, Because of Shyness, not aware of the Screening centre, No availability of service
Ilika et al 2016	NR, NR	Lack of awareness, Fear of positive result, did not know where to do the screening, Fear of vaginal examination, Fear of false positive screening results, Assumed Pap smear to be harmful, Lack of finances, No reason
Isara et al 2013	21, 9.1%	No reason was given, Felt it was not necessary to do a Pap smear, Did not know where to go for a Pap smear, Painful, Financial constraints
Jemal et al 2023	NR, NR	"Healthy", Don't know where to get screening, Carelessness, Fear of pain, Fear of positive result, Lack of time, Embarrassment
Jubelirer et al 1996	16, 5.7%	Embarrassment, Pain and discomfort, Fear of finding cancer, Fear of parents discovering sexual activity, Cost, Lack of access to the health care system

Kabirir et al 2021	NR, 21%	Embarrassment of male healthcare worker, Fear of pain, Feeling of shame, Fear of result, Cause of worry, If destined to get cancer then will, Not at risk, Not a priority, Can’t remember to schedule, Busy, Accessibility constraints, Difficulty finding location, Difficulty getting an appointment, Don’t know how to make an appointment, Long waiting hours, Lack of resources/stock, Lack of trained nurses, Cost, Not engaged in sexually risky behaviours, Spouse doesn’t allow it, Too young, For married people, Perception of screening as a negative experience, Fearful of contracting other diseases
Kahn et al 1999	NR, NR	Embarrassment, Pain, Cost, Impulsiveness of plans, Busy, Childcare, Accessibility, Negative perception of screening, Vulnerability, Fear of results, Cancer doesn't impact them, Embarrassment to have a exam by male, "don't want to look for trouble", Lack of knowledge, Fear of parents finding out, Difficulty getting an appointment, Denial, Fear of being diagnosed with pregnancy, Having a medical student present, Peers advised against
Kakubari et al 2020	141, 22.8%	I do not know what cervical cancer is, I don’t think I am affected with cervical cancer, Okay to get screening years later, I am scared to be diagnosed with CC, For now, I have no symptoms, I am afraid what the cancer screening examination is like, I do not want to go hospital or clinic, I am hesitant to go hospital or clinic, I have not experienced sexual intercourse, I don't want to spend my time for a medical check-up, It bothers me to go to the hospital or clinic, I do not know where to go for cancer screening
Karena et al 2024	5, 5.2%	Feeling vulnerable, Fear of result, Absence of symptoms, Not at risk, Haven’t decided, Other
Lee et al 2017	NR, NR	Limited knowledge about CC, screening guidelines: attributed to lack of opportunity and/or embarrassment to discuss sex-related matters, and participants belief that they were at low risk of getting CC. more familiar with vaccine than pap smear. Culture-specific barriers: cultural biases towards pap tests and vaccine and prejudice towards women's clinics, specifically gynaecology specialized clinics. Influence of those around them and negative attitudes discouraged participation. Uncomfortable visiting women's clinics. Perception that women’s clinic is only for married women. Seeking gynaecological examinations as a single woman is associated with unacceptable premarital sexual activity or promiscuity. Low accessibility to health care services: Lack of fluency in English. Unfamiliarity with the U.S. health care system, and limited knowledge about health care services for the Pap test and HPV vaccine.
Moreira et al 2006	166, 81.4%	Embarrassment, Fear of pain, Cannot get an appointment, Do not bother, Other, Embarrassment when undergoing pap smear

Moudatsou et al 2022	70, 70%	Fear of shame, not sexually active, not necessary, No reason, Other
Najem et al 1996	NR, 55%	Physician did not recommend, lack of awareness of pap test, cost, did not know where to get it, do not think pap test is necessary for them, did not know how to make an appointment, believed they were not at risk for cancer, believed pap test is not accurate, were embarrassed to have the test, did not have time for pap test
Natae et al 2021	34, 8.7%	Embarrassment, Fear of procedure, Fear of result, Lack of knowledge, Absence of symptoms, Spouse doesn't allow
Ndikom et al 2012	NR, NR	Cervical cancer screening was never a topic for discussion in the clinic, women are not utilizing it, only the elites utilize it, common belief is that what you don't know can't kill you, lack of awareness of cervical cancer and facilities for screening, it is not important to them, nonchalant attitude to one's health, financial constraints may be the cause sometimes, illiteracy, some people think that such services are for educated people, belief that positive result is death warrant if they are tested positive so it is better not to go for screening, screening services are not easily accessible, poor information dissemination by health workers.
Ngari et al 2021	NR, 18.7%	Lack of knowledge, No interest, Accessibility constraints, Cost, Spouse doesn't allow it, Religious beliefs, Lack of family support, Cultural biases
Ogbonna 2017	50, 26.9%	I don't have time for it, The reception/GP hours are not suitable for me, I am afraid the test will come out positive, I don't think it is necessary, Not applicable
Osei et al 2021	NR, NR	No sexual activity therefore not eligible, don't think it's necessary to screen, "I don't have the disease and am not sick", Lack of knowledge about screening type, over 50 years or "older" so will not be affected or motivated to screen, too busy with work to take time off
Oshima et al 2013	0, 0%	Did not feel "pushed" or encouraged to do so. busy lifestyle. Reluctance to visit the gynaecologist. Unable to speak about such an embarrassing subject with anyone else. Afraid to be seen visiting a gynaecological clinic. Worrying about what others might say about them. Fear or embarrassment (10, NR), the test entailed spreading the legs and exposing oneself.
Owoeye 2013	22, 12.1%	It is Painful, It is Expensive, It is Embarrassing, I am Healthy, Others, No Response

Pegu et al 2017	NR, NR	Felt that it was not needed, embarrassing, thought it might be costly and painful
Reiter et al 2014	291, 70%	Cost, embarrassment, lack of a health care provider recommendation, belief pap test is not necessary because they did not have any health problems, All other reasons reported >10%.
Rosita et al 2023	NR, NR	Lack of privacy, Embarrassment of male staff, Time consuming, Lack of interest, Difficulty getting an appointment, Cost, Fear of results, don’t know where to get screening, Lack of knowledge, Spousal constraints
Sadler et al 2013	NR, NR	Lack of knowledge, Fear, Embarrassment, being busy, Difficulty with making appointments, Reduced trust in health recommendations and disgruntlement with previous health care. 'don't feel the need' - especially because young, "related to how at risk you feel".
Shin et al 2021	0, 0%	Fear of procedure, Embarrassment of male healthcare worker, Lack of awareness, Busy, Worry of what others might say, Fear of parents finding out
Singh et al 2022	NR, 30%	Embarrassment, Fear of procedure, Absence of symptoms, Not at risk, Haven’t been advised by healthcare worker,
Singh et al 2012	15, NR	No reason, Not feeling at risk, Lack of symptoms, If a woman is a virgin, Pap test will take away her virginity, It is embarrassing to have a Pap test, Afraid of possible outcome, If I am destined to get cancer, Not applicable
Tadesse et al 2022	NR, 2.2%	Lack of knowledge. "healthy", Embarrassment, Cost, No reason
Tang et al 1999	NR, NR	Communication with mother, Openness around sexuality, Prevention orientation, Utilization of Western medicine
Tay et al 2015	815, NR	People I know do not do it, Embarrassing, Painful, no time, Not having sex. Not necessary.
Tesfaye et al 2022	120, 30.5%	Fear of result, No reason
Thapa et al 2018	49, 13.6%	No symptoms, Lack of awareness, Embarrassment, Carelessness, Fear of procedure, financial constraint, Lack of family support, Difficult accessibility, Lack of encouragement from health professional, Uncooperative health professionals

Ugonwanyi et al 2014	21, 12.2%	Fear of pain, Shyness, Lack of knowledge, Absence of symptoms, Haven't decided, Cost, Other
Wellensiek et al 2002	148, NR	Did not consider it necessary to have a Pap smear as yet, Had not had a Pap smear because they did not know about it, Afraid or embarrassed, No reason
Zaidi et al 2021	5, 3.4%	Lack of knowledge, Cost, Loss of Virginity due to test, Fear of genital warts

NR = Not reported EXP = Experimental group CON = Control group DELSUTH = UBTH = DELSUTH = Delta State University Teaching Hospital UBTH = University Benin Teaching Hospital CC = Cervical cancer CCS = Cervical cancer screening

APPENDIX C. Number of participants screened and reported facilitators to cervical screening per included study

Reference	Participants screened CC (n, %)	Facilitators (n, %)
Ackerson et al 2008	6, NR	Influencing individuals were mother, grandparents, friends, and a physician - influenced by her grandmothers' experiences and wanted to avoid the same thing happening to her. Being vulnerable to cervical cancer was also associated with taking good care of one's body by getting Pap smears that test for STDs and not having a family history specifically for cervical cancer
Alwahaibi et al 2017	Outpatients NR, 36.8%; Medical Staff NR, 23.3%	Reminded by health care professionals, Understood the importance of screening even when symptoms were absent, Reminded by family or/and friends. Reached the age when performing pap smear is necessary. Funded by the government. Ample time. Family/friends history. Health problems. Others
Anaman et al 2016	170, 66.9%	Doctors' recommendation's, Regular at the doctors, Personally asked for screening, Maternal involvement, Encouragement from family/friends, Community-based programme
Aniebue et al 2010	10, 5.2%	Doctors' recommendation
Bekele et al 2022	17, 2.5%	Health worker recommendation, Conversations with friends/relations, Self-conviction
Black et al 2011	NR, NR	Reminded by relative or a health-care provider. Pregnancy, in prison and prompted by health professional, Renewal of oral contraceptives was linked to annual CCS. Assistance with finding physician/health-care provider. Established relationship with a health-care provider or clinic. Education about pap tests (importance and what it entails). Availability of testing by a female provider. Preference for male physician, Event such as "Pap Day" or "Pap Week". Convenience. Friends reminding each other. Reminder and communication methods via email preferred.

Cooper et al 2018	NR, NR	Long term benefit focus: when comparing to negative outcomes of neglecting screening. Maternal involvement: mothers promoting pap smear, as a source of information regarding process and place Friends: friends urging, their previous experiences, discussions less common in those who hadn't and were overdue. Doctor: regular doctor made more comfortable in asking for screening. Previous pap smear facilitator for future pap smears.
Easwaran et al 2023	8, 5.7%	Previous health problems, Experience of symptoms, Routine
Enyan et al 2022	21, 4.9%	Routine, Referral, asked for test, Husband's encouragement, Family history, Fear of cancer, heard on the radio, Experience of symptoms, Education from the mosque, Education at the hospital
Head et al 2012	17, 89.5%	Maternal involvement
Kabirir et al 2021	NR, 21%	Communication with friends, Free, Can afford screening, Awareness, Long-term benefits focus, Health status, Belief reduces risk, Importance of health, Understand the importance of screening, Routine, Youth friendly services
Karena et al 2024	5, 5.2%	Experience of symptoms, Awareness, Part of general screening programme
Osei et al 2021	NR, NR	Free at the workplace. Free during cervical cancer screening month. Awareness of screening
Owoeye et al 2013	22, 12.1%	Doctor’s request, Free / Subsidized, Self-conviction, Part of a general screening Program, No response
Rosita et al 2023	NR, NR	Free, Easy access, Encouragement from husband, Encouragement from family, Convenient appointment, Lack of importance
Sadler et al 2013	NR, NR	"Less medical writing" on leaflet. Being told by nurse - ‘actually helped link it together and stuff, cos otherwise you’d think, I actually thought, it was kind of two different things.’
Tadesse et al 2022	NR, 2.2%	Health worker recommendation, heard on the news, Communication with friends/family, Information from teacher, Education from religious service, Heard from broacher or other

Tay et al 2015	815, NR	Belief that screening reduced cervical cancer risk, Screening was recommended by a doctor, Spouse recommended, Familiarity with the test through personal contacts. Someone close to me has done it, Husband said I should do it, People talk about it, Doctor said I should do it, Reduces cervical cancer risk.

NR = not reported STDs = sexual transmitted diseases CCS = cervical cancer screening

APPENDIX D. Number of participants screened and reported factors associated with cervical screening per included study

Reference	Participants screened CC (n, %)	Factors tested for their association with cervical screening attendance
Ackerson et al 2014	56, 84%	**Marital status**, **Smoking status**, **Age at first sex**, Lifetime number of sexual partners, **Perceived benefits**, **Perceived barriers**, Perceived vulnerability
Alwahaibi et al 2017	Outpatients NR, 36.8%; Medical Staff NR, 23.3%	**Marital status**, **Education level**
Alwahaibi et al 2018	Outpatients NR, 36.8%; Students NR, 23.3%	**Age**, **Marital status**, Education, **Husband's education**, **Family income**, **Family history of cancer**, **Parity**, **Knowledge**, **History of abortion**
Anaman et al 2016	170, 66.9%	Age, **Marital status**, Education, **Parity**, **Knowledge**, Religion, **Employment status**, Immigration status, **Perceived susceptibility**, Perceived severity, Health need status, Usual Source of Care, **Consultation with general practitioner**
Aniebue et al 2010	10, 5.2%	**Marital status**, Family income, Smoking history, Sexual activity
Anikwe et al 2021	NR, NR	Age, **Marital status**, Parity, Religion, Social class, Ethnicity
Annan et al 2019	NR, NR	**Screening/CC knowledge**, Perceived susceptibility, **Perceived severity**, perceived logistical barriers, Benefits-minus-barriers

Argaw et al 2022	78, 20.3	**Age**, Marital status, **Knowledge,** Smoking history, Lifetime number of sexual partners, STI
Aweke et al 2017	58, 9.9%	Age, Education, Income, Knowledge, **ever received information**, Religion, Husband's education, **Health seeking behaviour**
Ayinde et al 2004	35, 8.3%	**Marital status**, **Education**, Religion, Place of residence, **Sexual activity**
Bayu et al 2016	235, 19.8%	Age, Marital status, Employment status, Pregnancy, Household income, Age at first sex, **Lifetime number of sexual partners**, **History of STI**, **History of HIV**, Type of birth/delivery, **Knowledge**, **Perceived susceptibility**, Perceived severity **Perceived barriers**
Beer et al 2014	14 164, 45.9%	Age, **Deprivation scale**, Maternal age, Childhood vaccination status, **HPV vaccination**
Bekele et al 2022	17, 2.5%	**Education**, Marital status, **Attitude**, **Knowledge**
Binka et al 2016	NR, 8%	Age, Martial status, Religion, **Employment status**
Boone et al 2016	Unvac NR, 51%; Vacc NR, 59%	**Age**, **HPV vaccination**, **Screening initiation**, **Ethnicity**
Budd et al 2014	NR, NR	**Age**, **HPV vaccine**
Burak et al 1998	290, 72%	Perceived susceptibility, **Cues to action**, Perceived severity, **Benefits-minus-barriers**
Byrd et al 2004	NR, 69%	**Acculturation**, **Insurance status**, Education, **Perceived Severity**, **Perceived barriers**
Changkun et al 2022	NR, 21.6%	**Age**, Education, **Employment status**, **Insurance status**, **Media use/exposure**, **Religion**, **Wealth index**, **Head of household sex**, **Husband education**, **Place of residence**, **Husband/Partner role**
Chao et al 2017	NR, NR	Education, **Income**, **Pregnancy**, **HPV vaccination**, **Ethnicity**, **Routine hospital visit**, **STI**, Insurance status, **Abnormal pap result**

Dhendup et al 2014	34, 6%	**Age**, **Martial status**, Country of graduation, **Screening/CC knowledge**, **Recommended during last visit**
Dozie et al 2021	27, 7.2%	**Age**, **Marital Status**, **Education**, **Income**
Easwaran et al 2023	8, 5.7%	Education, Family history of cancer
Enyan et al 2022	21, 4.9%	Marital status, Insurance status, Employment status, **Income**, **Education**, Modesty, Religion, Self-sampling, **Knowledge**, Attitude, Cultural barriers, Perceived behavioural control
Gebisa et al 2022	NR, 6.3%	**Knowledge**, **Attitude**
Gebreegziabher et al 2016	24, 10.4%	Age, Marital status, Education, **Workplace**, Service years, Ethnicity, Parity, Knowledge, **Attitude**
Gebregziabher et al 2019	NR, 17.2%	**Age**, **Marital status**, **Education**, **Birthplace**, **Sexual activity**
Gebru et al 2016	NR, NR	**Age**, **Income**, **Parity**, Perceived susceptibility, Perceived severity
Gelassa et al 2023	77, 36%	**Education**, Use of family planning services, Abortion, **know someone with CC**, **Knowledge**, **Feeling at risk**, **Information on CC**
Guo et al 2017	Unvac NR, 75.6%; Vacc NR, 88.4%	**Age**, **Education**, **HPV vaccination**, **Ethnicity**, **Place of residence**, **Immigration status**, **Having a usual source of care**, **Routine check-up by OB/GYN in past year**, **Insurance status**
Hauwa et al 2021		**Education**, **Income**, Screening & CC Knowledge, **Religion, Attitude**, **Availability**
Hirth et al 2016	19 797, 79.3%	**Age**, **HPV vaccination**, **Vaccination provider**, **Time of vaccination doses**, Place of residence, **Usual source of care**, **History of cancer**, **Paediatric provider**

Hoque et al 2014	22. 15%	**Screening and CC knowledge**, HBM constructs, Perceived susceptibility, **Perceived logistical barriers**, **Self-efficacy**, **Benefit-minus-barriers**
Ilika et al 2016	NR, NR	Age
Isabirye et al 2022	1 338, 13.4%	**Age**, **Religion**, **Education**, **Employment**, **Insurance status**, **Place of residence**, **Contraception**, **Gravidity**, **Age at first sex**, **Wealth index**, **Media exposure**, **Marriage type**, **Household size**, **Birthplace**, **Attitudes towards IPV against women**, **Decision making autonomy**, **Household wealth index**, **Accessibility to healthcare**
Isara et al 2013	21, 9.1%	Screening & CC knowledge
Jemal et al 2023	NR, NR	Age, Marital status, **Education**, **Parity, Knowledge,** Employment status, **Number of sexual partners**
Kabirir et al 2021	NR, 21%	**Marital status**, **Education**, Religion, **Lifetime number of sexual partners**, Age at first sexual activity, **Sexual activity, Use of family planning services, Willingness to screen**
Kakubari et al 2020	Unvac 52, 17%; Vacc 89, 29%	**HPV vaccination**
Kaneko 2018	383, NR	**Age**, Education, **Income**, Screening/CC Knowledge, **Employment status**, **HPV vaccination**, Routine hospital visit, Smoking history, **Lifetime number of sex partners**, **Concerns regarding STIs**, Intervention, **Perceived susceptibility**, **Perceived logistical barriers**, **Confidence of undergoing screening with male physician**, Insurance status, Receipt of coupon for smear from government
Kim et al 2016	10 204, 100%	**Age, HPV vaccination**
Kitchener et al 2018	NR, NR	**HPV vaccination**, **Region**

Kreusch et al 2018	183 655, 70.2%	**HPV vaccination**, **Education**, Income, Migration, Screening invitation
Langille et al 2006	246, 45%	**Age**, Education, Parent's education, Parent's employment, **Place of residence**, **Seeing family as advantaged**, **Contraception**
Lee et al 2015	123, 75%	Age, **Marital status**, Education, Screening/CC knowledge, Employment status, Self-efficacy, Modesty, Fatalism, Health needs status, Insurance status
Letuka et al 2018	50, 15.2%	**Marital status**, **Education**, Household wealth index, **Place of residence**, Age at first sexual activity
Mather et al 2012	30, 48%	Age, Parents education, Family history of cancer, Religion, Importance of religion, HPV vaccination, Ethnicity, Sexual activity, Screening invitation,
Miyoshi et al 2021	NR, 12.6%	**HPV vaccination**
Moudatsou et al 2022	70, 70%	**Education**
Mpachika-Mfipa et al 2023	63, NR	**Knowledge, Source of information, Beliefs of CC,** Screening location, Lifetime sexual partners, **History of HIV, Willingness, Physician recommendation**
Mpachika-Mfipa et al 2022	63, NR	**Age,** Marital status, **Religion**, **Ethnicity**, **Place of residence**
Najem et al 1996	NR, 55%	**Age**, **Family income**, **Knowledge**, **Ethnicity**, **Smoking history**, **Sexual activity**, **Physicians recommendations**, **Previous screening by family member**
Natae et al 2021	34, 8.7%	**Age**, **Parity, Knowledge of screening,** Knowledge of CC**, Availability of screening, Routine check-up with OB/GYN in past year, History of cancer**

Ogbechie et al 2012	NR, 93.3%	**STI testing**
Owoeye et al 2013	22, 12.1%	**Awareness**
Park et al 2023	8,149, 46%	Age, **Employment status**, **Immigration status**, **Nationality**, **Place of residence**, **Deprivation scale**, **Comorbidity**, Consultation with general practioner
Paynter et al 2015	1 276, 55%	**Age, HPV vaccine**, **Parity**, **Gravidity**, **Ethnicity**
Pengpid et al 2014	NR, 11.6%	**Marital status**, **Household wealth index**, **Place of residence**, **Attitude**, **Smoking history**, **Lifetime number of sexual partners**, **Sexual activity**, **Sexual experience**, **STI**, **Benefits-minus-barriers**
Reiter et al 2014	291, 70%	**Age**, **Marital status**, Education, Income, **HPV knowledge**, Employment, **HPV vaccination**, **Ethnicity**, Urbanicity, **Lifetime number of sexual partners**, **Age at first sexual activity**, **Sexual identity**, **STI**, Worry of HPV-related disease, Perceived susceptibility, Perceived severity of HPV-related disease, **Perceived lower risk of CC compared to heterosexual women**, **Routine check-up by OB/GYN in past year**, **Insurance status**, **Disclosed sexual orientation to healthcare provider**, Discriminated against by healthcare provider
Sauer et al 2015	6 023, 82.6%	**Age**, **Education**, Income, **HPV vaccination**, Ethnicity
Sauvageau et al 2021	871, 59%	HPV vaccination
Seay et al 2022	NR, NR	**Age**, Ethnicity, Marital status, Education, Mental health, **Deployment status (Army)**, **Employment status**, Income
Shand et al 2010	NR, 63%	**Marital status**, Family history of cancer, **Sexual activity**, **Abnormal pap result**
Shin et al 2022	1,533, 39.1%	Age, Marital status, Number of births, **Maternal age**

Singh et al 2012	15, NR	**Marital status**
Tang et al 1999	NR, NR	Age, **Education**, Parents education, Family history of cancer, Health professionals in family, **Ethnicity**, **Cultural barriers**, **Acculturation**, **Sexual experience**, Sexual identity, Communication with mother, **Benefits-minus-barriers**, Usual source of care, **Health history**, **Routine check-up by OB/GYN in past year, General demographics**
Tay et al 2015	815, NR	**Age**, Screening/CC knowledge, Perceived susceptibility, Usual source of care, **Specialist consultation within past 3 years**, **Routine check-up by OB/GYN in past year**
Tesfaye et al 2022	120, 30.5%	**Age**, **Employment status**, **Source of information from health worker**, Source of information from printed materials, **Lifetime number of sexual partners**, **History of an STI**, **Knowledge**, **Attitude**
Thapa et al 2018	49, 13.6%	Age, **Marital status**, **Education**, **Ethnicity**, **Family history of cancer**, Knowledge. Attitude
Ugonwanyi et al 2014	21, 12.2%	**Perception of screening**
Wellensiek et al 2002	148, NR	**Education**, **Parity**, **Smoking history**, Age at first sexual activity, Sexual experience
Yi 1998	74, 36.8%	**Marital status**, Income, **Religion**, Birthplace, **Acculturation**, **Sexual activity**, **Usual source of care**, Insurance status
Yoo et al 2011	NR, 48%	**Age**, Screening/CC knowledge, HPV knowledge, **Ethnicity**, **Birthplace**, **Comfort with pap test**
Zaidi et al 2021	5, 3.4%	**Knowledge**

Bold = significant association NR = not reported Vacc = HPV vaccinated Unvac = not HPV vaccinated HPV = human papilloma virus CC = cervical cancer STI = sexually transmit infection HIV = human immunodeficiency virus OB/GYN = obstetrics and gynaecology IPV = intimate partner violence

APPENDIX E. Summary of main factors associated with screening cited in studies

Factors associated theme	Factors associated	Total N	Significant N	Direction
Socio-demographic factors				
	Age	31	20	Older
	Marital status	28	18	Married
	Education	28	16	Higher level
	Knowledge	24	16	Higher scores
	Employment status	14	9	Employed
	Sexual activity	13	8	Active
	Ethnicity	10	7	Mixed
	Lifetime sexual partners	10	7	More partners
	Parity	9	7	More children
	Income	9	5	Higher income
	Religion	12	5	Mixed
	History of STI	7	4	Yes
	Place of residence	9	6	Urban
	Smoking status	6	3	Smokers

Vaccination status				
	HPV vaccinated	12	11	Vaccinated
	Age and vaccination status	7	6	Vaccinated
	Race and vaccination status	3	3	Vaccinated
Psychological factors				
	Perceived susceptibility	11	5	Higher scores
	Perceived benefits and/or prevention orientation	6	5	Higher scores
	Perceived logistical barriers	6	5	Fewer
Previous experience				
	Insurance status	9	4	Insured
	Routine check-up/visited gynaecologists	5	5	Yes

Note: Yes = Yes to a history of STI & Yes to routine check-ups

APPENDIX F. Qualitative study ethics statement letter

Approved: 06/12/2023

Sonia Shpendi
Registration number: 210155039
Psychology
Programme: PhD in Psychology

Dear Sonia

PROJECT TITLE: Views about Cervical Cancer Screening in Young Women and People with a Cervix.
APPLICATION: Reference Number 057782

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 06/12/2023 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 057782 (form submission date: 05/12/2023); (expected project end date: 01/12/2024).
- Participant information sheet 1130237 version 3 (05/12/2023).
- Participant information sheet 1130238 version 2 (05/12/2023).
- Participant consent form 1130239 version 2 (05/12/2023).

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Department Of Psychology Research Ethics Committee
Ethics Admin
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/research-services/ethics-integrity/policy
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Admin (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

APPENDIX G. Qualitative study participant information sheet and consent form

https://shef.qualtrics.com/jfe/form/SV_dg2b3oa1BD1uS1g

INFORMATION SHEET

Project Title

Cervical Cancer Screening Attendance in Young Women and People with a Cervix.

Project purpose

This study is part of a PhD project investigating cervical cancer screening behaviours in young women. Duration? This study aims to research women aged 24-30 years' attitudes and opinions about attending their cervical cancer screening.

What will this research involve?

You are invited to take part in a 60 minute online interview via google meet, where you will be asked about your opinions and feelings towards getting a pap smear (also known as cervical cancer screening). All interviews will be recorded and will only be used for analysis and for illustration in conference presentations and lectures. Your participation will help bring light to where young girls your age stand when it comes to cervical cancer screening. You will be reimbursed a £20 shopping voucher for your time and participation.

Deciding to take part

You have been chosen to participate as you have recently been invited for cervical cancer screening. Participation is completely voluntary and It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time* without any negative consequences. You do not have to give a reason. If you wish to withdraw from the research, please contact Sonia Shpendi (sshpendi1@sheffield.ac.uk).

*Once data has been anonymised and included into the larger data set withdrawal will no longer be possible

Confidentiality & Data protection

Data is collected anonymously and any demographic information given is anonymised. Data will be stored in a secure google drive. All the information that we collect about you during the course of the research will be kept strictly confidential and will only be accessible to members of the research team. Participants will not be named in subsequent write ups and materials submitted for publication. All project data will be securely stored in University of Sheffield online data storage for up to 10 years after the study has been completed.

Further information

This study has been approved by the University of Sheffield Ethics Committee. The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

If you have a query about the research or wish to raise a complaint, please contact the researcher (sshpendi1@sheffield.ac.uk) or their supervisor (Dr. Jilly Gibson-Miller, jilly.gibson@sheffield.ac.uk). If you feel your complaint has not been handled satisfactorily, you can also contact the Head of the Psychology Department (Prof. Liz Miln, psy-hod@sheffield.ac.uk).

Please find below links to where you can get more information and support on the topics discussed in this study:

- Cervical screening and support -
    - https://www.nhs.uk/conditions/cervical-screening/
    - https://www.macmillan.org.uk/cancer-information-and-support/cervical-cancer
- Sexual health advice
    - https://www.nhs.uk/service-search/sexual-health

Consent

- I agree to take part in this study according to the information provided here
- I understand and agree that taking part in the project will include: participating in an interview
- I agree that whilst I am participating in this interview video recordings will be made. I agree to being video recorded and for these anonymised video recordings to be used in the research
- I agree that whilst I am participating in this interview audio recordings will be made. I agree to being audio recorded and for transcripts of these anonymised audio recordings to be used in the research
- I agree for the data in this study to be shared where deemed appropriate or necessary by the research team (this does not include any personal data)
- I understand that by choosing to participate as a volunteer in this research, this does not create a legally binding agreement nor is it intended to create an employment relationship with the University of Sheffield

Name of participant [printed] **Signature** **Date**

APPENDIX H. Qualitative study interview schedule

Main questions:

1. What do you know about cervical cancer screening?
2. Have you attended your screening?
3. What are some of the reasons you think why you haven't yet attended your screening?

    Prompt: What is it about that that stops you from going do you think?

    Prompt: What is it about that that you think you can overcome and still attend in comparison to other reasons?

4. What are some of the reasons you think why you took the steps to attend your screening?

    Prompt: How do you think you were able to overcome your personal barriers to screening?

    Prompt: How was your experience?

    Prompt: What expectations did you have about screening before attending?

    How did you feel after?

5. What would help you to attend your screening?

    Alternative: what do you think would help others to attend their screening?

6. Overall, how do you feel about cervical cancer screening?

    Prompt: Have you ever spoken to friends or family about screening?

Media and social media?

Top few reasons why you go?

7. Are you aware of the HPV vaccination and what it is for?

    i. What made you decide to get it?

    Prompt: Have you heard of any recent studies or news reports about the effectiveness of the HPV vaccine?

    If not…a recent study using the population-based cancer registry showed a 90% effectiveness against cervical cancer and a steep decline in cervical cancer cases.

    How do you feel about that?

    Did you think of vaccines when screening?

8. Has Covid changed your views?

APPENDIX I. Qualitative study demographic characteristics of participants

Characteristics		Median (Range)	Attendees n (%)	Non-attendees n (%)	Total n (%)
Age		27 (25 - 30)			
Ethnicity					
	White British or White Other		9 (75)	7 (58)	16 (67)
	Asian or Asian British		1 (8.)	4 (33)	5 (21)
	Black, Black British, Caribbean, or African		2 (17)	1 (8)	3 (13)
Place of residence					
	London		4 (33)	7 (58)	11 (46)
	Yorkshire and The Humber		1 (8)	2 (17)	3 (13)
	East of England		0 (0)	2 (17)	2 (8)
	West Midlands (England)		2 (17)	0 (0)	2 (8)
	East Midlands (England)		2 (17)	0 (0)	2 (8)
	Southeast (England)		2 (17)	0 (0)	2 (8)
	Southwest (England)		1 (8)	1 (8)	2 (8)
Education					
	Undergraduate degree		4 (33)	6 (50)	10 (42)
	Postgraduate degree		5 (42)	4 (33)	9 (38)

	Higher certificates	3 (25)	0 (0)	3 (13)
	A-level, National Diploma or equivalent	0 (0)	1 (8)	1 (4)
	PhD	0 (0)	1 (8)	1 (4)
Relationship status				
	Partnered	7 (58)	4 (33)	11 (46)
	Single	2 (17)	5 (42)	7 (29)
	Married	3 (25)	1 (8)	4 (17)
	Other	0 (0)	2 (17)	2 (8)
Religion				
	Not religious	7 (58)	5 (42)	12 (50)
	Catholicism/Christianity	3 (25)	4 (33)	7 (29)
	Islam	2 (17)	2 (17)	4 (17)
	Sikhism	0 (0)	1 (8)	1 (4)
Employment status				
	Employed	8 (67)	7 (58)	15 (63)
	Part-time	1 (8)	5 (42)	6 (25)
	Studying	2 (17)	0 (0)	2 (8)
	Self-employed/Freelance	1 (8)	0 (0)	1 (4)

APPENDIX K. Qualitative study HPV vaccination data of participants

HPV Vaccination		Attendees n(%)	Non-attendees n(%)	n (%)
HPV vaccinated				
	Yes	7 (58)	6 (50)	13 (54)
	No	5 (42)	6 (50)	11 (46)
Number of doses				
	Two or more	4 (33)	4 (33)	8 (33)

	One	3 (25)	2 (17)	5 (21)
Location of vaccination				
	School	5 (42)	4 (33)	9 (38)
	Healthcare services	2 (17)	2 (17)	4 (17)

APPENDIX L. Qualitative study demographic questionnaire

Demographic questionnaire (Offline version - for records only)

Participant ID:

Gender: “What gender do you identify as?”

- Male
- Female
- _____ (Short answer space)
- Prefer not to answer

Age:

Ethnicity: “Please specify your ethnicity - select one category that you feel best represents your ethnicity”

- Asian or Asian British (*Indian, Pakistani, Bangladeshi, Chinese and/or Any other Asian background*)
- Black, Black British, Caribbean or African (*Caribbean, African and/or Any other Black, Black British, or Caribbean background*)
- Mixed or multiple ethnic groups (*White and Black Caribbean, White and Black African, White and Asian and/or Any other Mixed or multiple ethnic background*)
- White (*English, Welsh, Scottish, Northern Irish or British, Irish, Gypsy or Irish Traveller, Roma and/or Any other white background*)
- Other ethnic group (*Arab and/or any other ethnic group*)
    - Please specify further:_____

Location: “where is your home base?”

- North East (England)

- North West (England)
- Yorkshire and The Humber
- East Midlands (England)
- West Midlands (England)
- East of England
- London
- South East (England)
- South West (England)
- Scotland
- Wales
- Northern Ireland

Education: “What is the highest degree or level of education you have completed?”

- GCSE
- A-level, National Diploma or equivalent
- Undergraduate degree
- Higher certificates (*including Advanced Apprenticeship/Diplomas*)
- Postgraduate degree (*including all master’s degrees*)
- PhD
- Other:_____

Relationship status: “what is your current relationship status”

- Single
- Married
- Partnered
- Other

Religion: “what religion do you identify most with?”

- Catholicism/Christianity
- Judaism
- Islam
- Buddhism
- Hinduism
- Other:_____
- Prefer not to say
- Not religious

Employment: “What is your employment status?”

- Employed
- Self-employed/Freelance
- Interning
- Part-time
- Unemployed- Looking for work
- Unemployed- Not looking for work
- Homemaker
- Studying
- Military/ Forces
- Retired
- Not able to work
- Other: _____

HPV vaccine: “Have you received your HPV vaccine?”

- Yes
- No

  If Yes, How many doses of the vaccine have you received?

- One dose
- Two or more doses

Where did you receive your HPV vaccination?

- School
- Healthcare services (Sexual health clinic and/or GP)
- Other: _____

APPENDIX M. Cross-sectional study ethics statement letter

The University Of Sheffield.

Downloaded: 14/09/2025
Approved: 02/08/2022

Sonia Shpendi
Registration number: 210155039
Psychology
Programme: PhD

Dear Sonia

PROJECT TITLE: Barriers, facilitators and factors associated with cervical cancer screening attendance in young women
APPLICATION: Reference Number 047229

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 02/08/2022 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 047229 (form submission date: 08/07/2022); (expected project end date: 30/12/2022).
- Participant information sheet 1107547 version 2 (08/07/2022).
- Participant consent form 1107548 version 2 (08/07/2022).

The following amendments to this application have been approved:

- Amendment approved: 22/09/2022
  - DMP_updated_22.09.pdf
- Amendment approved: 15/09/2022
  - recruitment_closure_email_example.png
  - Copy_of_Participant_information_sheet_and_consent_form_example__1_.pdf
  - Recruitment_flyer_CC__1_.pdf

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Department Of Psychology Research Ethics Committee
Ethics Admin
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/research-services/ethics-integrity/policy
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Admin (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

APPENDIX N. Cross-sectional survey study participant information sheet and consent form

INFORMATION SHEET

You are being invited to take part in a research project. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

- Project Title

Views about Cervical Cancer Screening in Young Women and People with a Cervix.

- Project purpose

This study is part of a PhD project investigating cervical cancer screening behaviours in young women and people with a cervix. The study aims to research those aged 25-30 years and the factors influencing their decisions on whether or not to attend cervical cancer screening.

- Eligibility criteria

- Aged 25-30 and eligible for cervical screening.
- Have not attended cervical screening before invitation under the government cervical screening programme (before the age of 24)
- Do not have a personal history of cervical cancer or have had a hysterectomy procedure
- Can read or write English

- What will this research involve?

You are invited to take part in a questionnaire, where you will be asked about your opinions and feelings towards cervical cancer screening (also known as getting a pap smear). Data will be used for analysis and illustration in conference presentations and journal publications. Your participation will help us understand people's opinions and feelings about where young people your age stand when it comes to cervical cancer screening. You will be reimbursed at a rate of £9 per hour (pro rata) via Prolific for your time and participation.

- Deciding to take part

You have been chosen to participate as you are eligible to have cervical cancer screening under the NHS cervical screening programme and have a Prolific account. Participation is completely voluntary and it is up to you to decide whether or not to take part. Before you decide to take part (or not) we ask that you read this information sheet and complete the consent form on the next page.

You can still decide to withdraw from the study until 31/1/24 without any negative consequences (up until the point that Prolific IDs are removed from the data files). You do not have to give a reason. If you wish to withdraw your data from the research, please contact Sonia Shpendi (sshpendi1@sheffield.ac.uk).

By taking part in this study you will be contributing to furthering knowledge and understanding about cervical cancer screening behaviours in your age group, which we hope could help improve screening rates. There are no risks to taking part in this study. However, if you feel that answering questions on your views about cervical cancer screening is likely to cause you any distress, you can simply decide not to take part in the study. We have also provided some links provided at the end of this information sheet for more information and support.

- Confidentiality & Data protection

Data is collected and anonymised at the end of data collection. Once the quota for data collection has been met for both groups, Prolific IDs will be removed and replaced with unique research IDs. All data will be stored in a secure Google Drive. All the information that we collect about you during the research will be kept strictly confidential and will only be accessible to members of the research team. Anonymised data will be uploaded onto an online repository for use by other researchers. This will not include any identifiable information. Participants will not be named in subsequent write-ups and materials submitted for publication.

All project data will be securely stored in the University of Sheffield online data storage for up to 10 years after the study has been completed.

- Further information

This study has been approved by the University of Sheffield Ethics Committee. The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

If you have a query about the research or wish to raise a complaint, please contact the researcher (sshpendi1@sheffield.ac.uk) or their supervisor (Dr Rebecca Webster, r.k.webster@sheffield.ac.uk). If you feel your complaint has not been handled satisfactorily, you can also contact the Head of the Psychology Department (Prof. Liz Milne, psy-hod@sheffield.ac.uk).

Please find below links to where you can get more information and support on the topics discussed in this study:

- Cervical screening and support -
    - https://www.nhs.uk/conditions/cervical-screening/
    - https://www.macmillan.org.uk/cancer-information-and-support/cervical-cancer
- Sexual health advice
    - https://www.nhs.uk/service-search/sexual-health

Consent

- I agree to take part in this study according to the information provided here
- I understand and agree that taking part in the project will include: completing all questionnaires
- I agree for the data in this study to be shared where deemed appropriate or necessary by the research team (this does not include any personal data)
- I agree for the data to be used in future research publication or dissemination

- I give permission for the data I have provided to be deposited in the University of Sheffield repository ORDA so it can be used for future research and learning
- I understand that choosing to participate as a volunteer in this research, does not create a legally binding agreement nor is it intended to create an employment relationship with the University of Sheffield
- I consent to be contacted again for any future research or follow-up of this questionnaire via my prolific ID
- I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield

- I consent to participate

APPENDIX O. Cross-sectional survey study main questionnaire

Demographic section:

1. What is your Prolific ID?
   Please note that this response should auto-fill with the correct ID:

2. Please specify your ethnicity - select one category that you feel best represents your ethnicity

Asian or Asian British (Indian, Pakistani, Bangladeshi, Chinese and/or Any other Asian background)

Black, Black British, Caribbean or African (Caribbean, African and/or Any other Black, Black British, or Caribbean background)

Mixed or multiple ethnic groups (White and Black Caribbean, White and Black African, White and Asian and/or Any other Mixed or multiple ethnic background)

White (English, Welsh, Scottish, Northern Irish or British, Irish, Gypsy or Irish Traveller, Roma and/or Any other white background)

Other ethnic group (Arab and/or any other ethnic group)

Please specify further:_____

3. What gender do you identify as?

Male

Female

Trans/Male/Trans Man

Trans Female/Trans Women

Other (please answer in the space given)

Prefer not to answer

4. What is the highest degree or level of education you have completed?

GCSE

A-level, National Diploma or equivalent

Undergraduate degree

Higher certificates (including Advanced Apprenticeship/Diplomas)

Postgraduate degree (including all master's degrees)

PhD

Other:_____

5. What is your current relationship status?

Single

Married

Partnered

Other

6. What religion do you identify most with?

Catholicism/Christianity

Judaism

Islam

Buddhism

Hinduism

Prefer not to say

Not religious

Other:_____

7. How would you rate your health status?

Poor

Fair

Good

Excellent

8. Do you have a longstanding illness, disability or infirmity that limits daily activities in any way, compared to people of the same age?

Yes

No

9. Have you had the HPV vaccine? (This is a vaccine to protect against viruses that can cause cervical cancer. It is usually given in two doses (aged 12/13 or school year 8) or free for anyone under 25 years old)

Yes

No

Not sure

7a. If Yes, How many doses of the vaccine have you received?

One dose

Two or more doses

Don’t know/not sure

COM-B items section
Scale: Strongly disagree - Strongly agree (rate -5 - 5 (10 response options)

Capability

I am psychologically able to attend cervical cancer screening.

(What is psychological capability? *Knowledge and/or psychological skills, strength or stamina to engage in the necessary thought processes to attend cervical cancer screening)*

- I know what cervical cancer screening is for
- I know why cervical cancer screening is needed
- I know how cervical cancer screening is carried out
- Cervical cancer screening is something you do when you are older (35+)
- Cervical cancer screening is not needed at my age
- I know about the link between the HPV vaccination and cervical cancer
- I take into consideration my HPV vaccination status when deciding whether or not to attend my cervical cancer screening
- I know how to book a cervical cancer screening appointment
- I know where to find information about cervical cancer screening

Opportunity

I have the social opportunity to attend a cervical cancer screening.

(What is social opportunity? Interpersonal influences, social cues and cultural norms provide the opportunity to attend cervical cancer screening, e.g support from friends and family)

- I am aware of others in my social circle/community who have attended their cervical cancer screening
- I am comfortable discussing cervical cancer screening experiences with my social circle
- In the past, I have learnt about cervical cancer screening from friends and family
- Someone in my family or close to me has been diagnosed with cancer
- I have received encouragement to attend my cervical cancer screening from my GP
- I value encouragement from my GP to attend my cervical cancer screening

I have the physical opportunity to attend cervical cancer screening.

(What is the physical opportunity? The environment provides the opportunity to engage in cervical cancer screening, e.g. sufficient time, the necessary materials, reminders)

- Booking a cervical cancer screening is difficult for me
- It's easy for me to book a cervical cancer screening appointment
- I am too busy to attend a cervical cancer screening
- I am too busy to book a cervical cancer screening

Motivation

I am motivated to attend cervical cancer screening.

(What is motivation? Conscious planning and evaluations (beliefs about what is good and bad, e.g. I have the desire to, I feel the need to) about cervical cancer screening)

- Cervical cancer screening is important
- I do not perceive myself to be at risk of cervical cancer
- I am no more at risk of cervical cancer than anyone my age
- I intend to go to my cervical cancer screening
- I intend to go to my cervical cancer screening every time I am invited
- Cervical cancer screening is not a current priority for me
- I believe attending my cervical cancer screening is worthwhile
- I believe attending my cervical cancer screening will benefit me
- I have had previous negative experiences with health-related screening or at the GP

Attending cervical cancer screening is something that I do automatically.

(Automatic motivation involves doing something (or not) without giving it much thought or based on strong emotions e.g 'is something I do before I realise I'm doing it")

- Cervical cancer screening is embarrassing for me
- I am scared of the cervical cancer screening procedure
- Attending my cervical cancer screening would reassure me about my health
- I expect everything will be OK if attend my cervical cancer screening
- If I attend my cervical cancer screening I feel optimistic about my health in the future

APPENDIX P. Cross-sectional survey study demographics data and associations with screening attendance

Variable		Attendees	Non-attendees	Total	Unadjusted OR (CI 95%)	*p*
		n	n	n (%)		
Gender	Female	98	94	192 (96)	3.13 (0.62 - 15.89)	.17
	Prefer self-identify	2	6	8 (4)		
Ethnicity	White British or White Other	84	71	155 (77.5)	2.14 (1.08 - 4.26)	.03*
	Other	16	29	45 (22.5)		
Place of residence	England	90	88	178 (89)	1.23 (0.50 - 3.00)	.65
	Scotland, Northern Ireland and Wales	10	12	22 (11)		

Education	Higher education	84	74	158 (79)	1.85 (0.92-3.70)	.85
	School level education	16	26	42 (21)		
Relationship status	Partnered	65	51	116 (58)	1.78 (1.01 - 3.15)	.046*
	Other	35	49	84 (42)		
Religion	Not Religious	73	59	132 (66)	0.52 (0.28 - 0.97)	.04*
	Religious	24	37	61 (30.5)		
	Prefer not to say [a]	3	4	7 (3.5)		
Employment status	Employed	76	61	137 (68.5)	2.77 (1.18 - 6.52)	.02*
	Not Employed	9	20	29 (14.5)		
	Missing [a]	15	19	34 (17)		
Longstanding illness,	No	90	75	165 (82.5)	0.33 (0.15 - 0.74)	.007*

disability or infirmity	Yes	10	25	35 (17.5)		
Received screening invitation letter	Yes	96	83	179 (89.5)	5.40 (1.50 - 19.43)	.01*
	No	3	14	17 (8.5)		
	Don't know / Not sure [a]	1	3	4 (2)		
HPV vaccinated	Yes	78	62	140 (70)	2.17 (1.11 - 4.23)	.02*
	No	18	31	49 (24.5)		
	Not sure	4	7	11 (5.5)		
Number of doses	Two or more	62	44	106 (53)	2.82 (0.67 - 11.88)	.158
	One	3	6	9 (4.5)		
	Not sure [a]	13	12	25 (12.5)		
		Mean (SD)	**Mean (SD)**	**Mean (SD)**		

Age	27.89 (1.75)	27.31 (1.73)	27.60 (1.76)	1.21 (1.03-1.43)	.02*
Health status	2.47 (0.75)	2.56 (0.82)	2.52 (0.78)	0.86 (0.60 - 1.23)	.42

Note. * $p < .05$. [a] Don't know/Not sure/Missing responses were excluded from the analysis.

APPENDIX Q. Cross-sectional survey study full demographic frequencies

Characteristics		**Attendees n (%)**	**Non-attendees n (%)**	**Total n (%)**
Age				
	25	12	22	34 (17)
	26	14	15	29 (14.5)
	27	17	15	32 (16)
	28	13	15	33 (16.5)
	29	18	14	32 (17)
	30	26	14	40 (20)
Gender				
	Female	98	94	192 (96)
	Trans Male/Trans Man	0	2	2 (1)
	Other	2	4	6 (3)
	Non-binary	*1*	*2*	*3*
	No gender	*1*	*1*	*2*
	Trans Masc	0	*1*	*1*
Ethnicity				
	White British or White Other	84	71	155 (77.5)

	Asian or Asian British	10	18	28 (14)
	Black, Black British, Caribbean or African	2	6	8 (4)
	Mixed or multiple ethnic groups	4	4	8 (4)
	Other ethnic groups (Arab and/or any other ethnic group)	0	1	1 (0.5)
Place of residence				
	London	15	18	33 (16.5)
	Scotland	4	8	12 (6)
	Northern Ireland	3	2	5 (2.5)
	Wales	3	2	5 (2.5)
	Yorkshire and The Humber	13	8	21 (10.5)
	East of England	12	11	23 (11.5)
	North East (England)	3	3	6 (3)
	North West (England)	13	7	20 (10)
	West Midlands (England)	7	8	15 (7.5)
	East Midlands (England)	7	9	16 (8)
	South East (England)	14	15	29 (14.5)
	South West (England)	6	9	15 (7.5)
Education				
	Undergraduate degree	44	35	79 (39.5)

	Postgraduate degree	35	32	67 (33.5)
	Higher certificates	5	5	10 (5)
	A-level, National Diploma or equivalent	13	18	31 (15.5)
	GCSE	3	8	11 (5.5)
	PhD	0	2	2 (1)
Relationship status				
	Partnered	47	40	87 (43.5)
	Single	32	49	81 (40.5)
	Married	18	11	29 (14.5)
	Other	3	0	3 (1.5)
Religion				
	Not religious	73	59	132 (66)
	Catholicism/Christianity	19	21	40 (20)
	Islam	3	12	15 (7.5)
	Prefer not say	3	4	7 (3.5)
	Buddhism	0	1	1 (0.5)
	Hinduism	0	1	1 (0.5)
	Judaism	1	1	2 (1)
	Paganism	1	1	2 (1)
Employment status				
	Full-Time	66	46	112 (56)

	Part-Time	10	14	24 (12)
	Unemployed (and job seeking)	4	11	15 (7.5)
	Not in paid work (e.g. homemaker, retired or disabled)	5	9	14 (7)
	Due to start within the next month	0	1	1 (0.5)
	Missing data/ data expired	15	19	34 (17)
Health status				
	Good	62	53	115 (57.5)
	Fair	23	26	49 (24.5)
	Excellent	15	13	28 (14)
	Poor	0	8	8 (4)
Longstanding illness, disability or infirmity that limits daily activities				
	No	90	75	165 (82.5)
	Yes	10	25	35 (17.5)

APPENDIX R. Cross-sectional survey study associations between individual reflective motivation items and screening attendance

Reflective Motivation Items	**Attendees**	**Non-attendees**	**Total**	**Unadjusted OR (95% CI)**	***p-value***
	Mean (SD)	**Mean (SD)**	**Mean (SD)**		
I am motivated to attend cervical cancer screening	3.28 (2.53)	-1.29 (3.15)	1.16 (3.64)	**1.58 (1.40 - 1.79)**	**<.001***
Cervical cancer screening is important	4.47 (0.73)	3.13 (2.14)	3.99 (1.74)	**2.43 (1.72 - 3.41)**	**<.001***
I do not perceive myself to be at risk of cervical cancer	2.57 (1.93)	2.55 (1.77)	2.56 (1.85)	1.01 (0.86 - 1.18)	0.946
I am no more at risk of cervical cancer than anyone my age	2.52 (2.02)	2.37 (2.03)	2.45 (2.02)	1.04 (0.90 - 1.20)	0.625
I intend to go to my cervical cancer screening	4.22 (1.78)	-0.55 (3.55)	2.01 (3.64)	**1.75 (1.49 – 2.06)**	**<.001***
I intend to go to my cervical cancer screening every time I am invited	3.96 (2.09)	-1.40 (3.31)	1.47 (3.81)	**1.73 (1.50 - 2.00)**	**<.001***
Cervical cancer screening is not a current priority for me	3.39 (1.74)	2.98 (1.68)	3.20 (1.72)	1.15 (0.97 - 1.37)	0.113
I believe attending my cervical cancer	4.46 (1.42)	1.63 (3.19)	3.15 (2.74)	**1.93 (1.53 - 2.42)**	**<.001***

screening is worthwhile					
I believe attending my cervical cancer screening will benefit me	4.19 (1.42)	1.40 (3.28)	2.89 (2.74)	**1.66 (1.39 - 1.99)**	**<.001***
I have had previous negative experiences with health-related screening or at the GP	3.68 (1.61)	3.23 (1.71)	3.47 (1.67)	1.18 (0.98 – 1.41)	0.074

APPENDIX S. Cross-sectional survey study sensitivity analysis

Demographic data and associations with screening attendance (excluding those who have not received a screening invitation)

Variable		Attendees	Non-attendees	Total	Unadjusted OR (CI 95%)	*p*
		n	n	n (%)		
Gender	Female	94	78	172 (96.1)	3.01 (0.57 - 15.96)	.195
	Prefer self-identify	2	5	7 (3.9)		
Ethnicity	White British or White Other	80	63	143 (79.9)	1.587 (0.76 – 3.31)	.218
	Other	16	20	36 (20.1)		
Place of residence	England	88	72	160 (89.4)	1.68 (0.64 – 4.40)	.290
	Scotland, Northern Ireland	8	11	19 (10.6)		

	and Wales					
Education	Higher education	81	60	141 (78.8)	2.07 (1.00-4.30)	.051
	School level education	15	23	38 (21.2)		
Relationship status	Partnered	63	40	103 (57.5)	2.05 (1.12 - 3.75)	.019 *
	Other	33	43	76 (42.5)		
Religion	Not Religious	70	54	124 (69.3)	0.71 (0.37 – 1.38)	.312
	Religious	24	26	50 (27.9)		
	Prefer not to say [a]	2	3	5 (2.8)		
Employment status	Employed	74	47	121 (67.6)	3.15 (1.31 – 3.15)	.011 *
	Not Employed	9	18	27 (15.1)		
	Missing [a]	13	18	31 (17.3)		
Longstanding illness,	No	87	63	150 (83.8)	0.33 (0.14 - 0.76)	.010 *

disability or infirmity	Yes	9	20	29 (16.2)		
HPV vaccinated	Yes	74	53	127(70.9)	1.78 (0.88 - 3.63)	.110
	No	18	23	41 (22.9)		
	Not sure	4	7	11 (6.1)		
Number of doses	Two or more	59	38	97 (54.2)	2.07 (0.44 - 9.77)	.358
	One	3	4	7 (3.9)		
	Not sure [a]	12	11	23 (12.8)		
Age		**Mean (SD)**	**Mean (SD)**	**Mean (SD)**		
		27.84 (1.76)	27.42 (1.73)	27.65 (1.76)	1.15 (0.97-1.36)	.109
Health status		2.48 (0.74)	2.58 (0.80)	2.5 (0.77)	0.84 (0.57 - 1.24)	.388

Note. * $p < .05$. [a] Don't know/Not sure/Missing responses were excluded from the analysis.

COM-B components and associations with screening attendance (excluding those who have not received a screening invitation)

Variable	Attendees	Non-attendees	Unadjusted OR (95% CI)	*p*-value
	Mean (SD)	**Mean (SD)**		
Psychological Capacity	3.35 (0.97)	2.57 (1.24)	1.93 (1.42 - 2.60)	<.001*
Social Opportunity	2.50 (1.73)	0.99 (2.19)	1.47 (1.24 - 1.74)	<.001*
Physical Opportunity	3.90 (1.14)	2.78 (1.36)	1.98 (1.53 - 2.56)	<.001*
Reflective Motivation	3.70 (1.10)	1.40 (1.56)	2.91 (2.17 - 3.90)	<.001*
Automatic Motivation	2.58 (1.51)	0.60 (1.56)	2.28 (1.76 - 2.96)	<.001

Note. * $p < .05$.

Summary of multiple logistic regression analysis predicting screening attendance (excluding those who have not received a screening invitation).

Variable	**Adjusted OR (95% CI)**	***p*-value**
Relationship Status	1.86 (0.71 – 4.87)	.208
Employment Status	0.64 (0.16 – 2.59)	.640
Longstanding Illness	0.27 (0.75 – 0.99)	.049*
Psychological Capacity	1.21 (0.71 - 2.05)	.487
Social Opportunity	0.92 (0.71 – 2.05)	.600
Physical Opportunity	0.83 (1.05 – 0.67)	.829
Reflective Motivation	2.37 (1.47 – 3.83)	<.001*
Automatic Motivation	1.33 (0.91 - 1.96)	.141

Note. * $p < .05$.

Associations between individual reflective motivation items and screening attendance (excluding those who have not received a screening invitation).

Reflective Motivation Items	**Attendees**	**Non-attendees**	**Total**	**Unadjusted OR (95% CI)**
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	
I am motivated to attend cervical cancer screening	3.22 (2.55)	-1.08 (3.22)	1.07 (3.61)	**1.54 (1.37 - 1.73)***
Cervical cancer screening is important	4.72 (0.74)	3.19 (2.14)	3.96 (1.77)	**2.26 (1.66 - 3.08)***
I do not perceive myself to be at risk of cervical cancer	2.59 (1.94)	2.48 (1.82)	2.54 (1.88)	1.03 (0.89 - 1.20)
I am no more at risk of cervical cancer than anyone my age	2.49 (2.02)	2.35 (1.98)	2.42 (2.00)	1.04 (0.90 - 1.91)
I intend to go to my cervical cancer screening	4.17 (1.82)	-0.21 (3.55)	1.98 (3.57)	**1.71 (1.47 - 1.99)***
I intend to go to my cervical cancer screening every time I am invited	3.92 (2.08)	-0.91 (3.46)	1.51 (3.74)	**1.66 (1.45 - 1.90)***
Cervical cancer screening is not a current priority for me	3.37 (1.76)	2.83 (1.67)	3.10 (1.74)	**1.20 (1.02 - 1.42)***
I believe attending my cervical cancer screening is worthwhile	4.43 (1.23)	1.81 (3.18)	3.12 (2.74)	**1.81 (1.47 - 2.22)***
I believe attending my cervical cancer screening will benefit me	4.18 (1.42)	1.60 (3.26)	2.89 (2.82)	**1.61 (1.36 - 1.91)***
I have had previous negative experiences with health-	3.65 (1.62)	3.23 (1.71)	3.44 (1.67)	1.17 (0.98 – 1.38)

related screening or at the GP

APPENDIX T. Randomised control trial ethics statement letter

Downloaded: 11/10/2025
Approved: 02/07/2024

Sonia Shpendi
Registration number: 210155039
Psychology
Programme: PhD in Psychology

Dear Sonia

PROJECT TITLE: The impact of an infographic leaflet on intention to attend cervical screening: A randomised controlled trial.
APPLICATION: Reference Number 062668

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 02/07/2024 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 062668 (form submission date: 02/07/2024); (expected project end date: 25/06/2025).
- Participant information sheet 1139901 version 3 (02/07/2024).
- Participant consent form 1139902 version 3 (02/07/2024).

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Department Of Psychology Research Ethics Committee
Ethics Admin
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/research-services/ethics-integrity/policy
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Admin (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

APPENDIX U. Randomised controlled trial participant information and consent form

INFORMATION SHEET

You are being invited to take part in a research project. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will involve. Please take the time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

- Project Title

Views about Attending Cervical Cancer Screening in Young Women and People with a Cervix.

- Project purpose

This study is part of a PhD project investigating cervical cancer screening behaviours in young women and people with a cervix. The study aims to research those aged 23 years and is interested in young women and people with a cervix's views on information about attending cervical cancer screening.

- Eligibility criteria
- Aged 23 and are not yet eligible for cervical screening.
- Have not attended cervical screening before invitation under the government cervical screening programme (before the age of 24)
- Do not have a personal history of cervical cancer or have had a hysterectomy procedure
- Can read or write English

- What will this research involve?
-

You are invited to take part in a research project, where you will be asked to complete a questionnaire about your opinions and feelings towards cervical cancer screening (also known as getting a pap smear). You will also be asked to view some information about cervical cancer screening. Data will be used for analysis and illustration in conference presentations and journal publications. Your participation will help us understand people's reactions to information about cervical cancer screening. You will be reimbursed at a rate of £9 per hour (pro rata) via Prolific for your time and participation.

- Deciding to take part

You have been chosen to participate as you are aged 23 years old, will be eligible in the future to have cervical cancer screening under the NHS cervical screening programme and have a Prolific account. Participation is completely voluntary and it is up to you to decide whether or not to take part. Before you decide to take part (or not) we ask that you read this information sheet and complete the consent form on the next page.

You can still decide to withdraw from the study until 31/08/24 without any negative consequences. You do not have to give a reason. If you do wish to withdraw your data please contact Sonia Shpendi via email (sshpendi1@sheffield.ac.uk) or Prolific.

By taking part in this study you will be contributing to furthering knowledge and understanding about cervical cancer screening behaviours in your age group, which we hope could help improve screening rates. There are no risks to taking part in this study. However, if you feel that answering questions on your views about cervical cancer screening is likely to cause you any distress, you can simply decide not to take part in the study. We have also provided some links provided at the end of this information sheet for more information and support.

- Confidentiality & Data protection

All data will be stored in a secure Google Drive. All the information that we collect about you during the research will be kept strictly confidential and will only be accessible to members of the research team. You may be contacted and offered future participation in any follow-up studies to further this research. Anonymised data will be uploaded onto an online repository for use by other researchers. This will not include any identifiable information. Participants will not be named in subsequent write-ups and materials submitted for publication. All project data will be securely stored in the University of Sheffield online data storage for up to 10 years after the study has been completed.

- Further information

This study has been approved by the University of Sheffield Ethics Committee (062668). The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

If you have a query about the research or wish to raise a complaint, please contact the researcher (sshpendi1@sheffield.ac.uk) or their supervisor (Prof. Paul Norman, p.norman@sheffield.ac.uk). If you feel your complaint has not been handled satisfactorily, you can also contact the Head of the Psychology Department (Dr. Chris Martin, psy-hod@sheffield.ac.uk).

Please find below links to where you can get more information and support on the topics discussed in this study:

- Cervical screening and support -
    - https://www.nhs.uk/conditions/cervical-screening/
    - https://www.macmillan.org.uk/cancer-information-and-support/cervical-cancer
- Sexual health advice
    - https://www.nhs.uk/service-search/sexual-health

Consent

- I agree to take part in this study according to the information provided here
- I understand and agree that taking part in the project will include: completing all questionnaires
- I agree for the data in this study to be shared where deemed appropriate or necessary by the research team (this does not include any personal data)
- I agree for the data to be used in future research publication or dissemination
- I give permission for the data I have provided to be deposited in the University of Sheffield repository ORDA so it can be used for future research and learning

- I understand that choosing to participate as a volunteer in this research, does not create a legally binding agreement nor is it intended to create an employment relationship with the University of Sheffield
- I consent to be contacted again for any future research or follow-up of this questionnaire via my Prolific ID
- I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield

- I consent to participate

APPENDIX V. Randomised controlled trial Consort checklist

Section/topic	No	CONSORT 2025 checklist item description	Reported on page no.
Title and abstract			
Title and structured abstract	1a	Identification as a randomised trial	124
	1b	Structured summary of the trial design, methods, results, and conclusions	124
Open science			
Trial registration	2	Name of trial registry, identifying number (with URL) and date of registration	128
Protocol and statistical analysis plan	3	Where the trial protocol and statistical analysis plan can be accessed	128
Data sharing	4	Where and how the individual de-identified participant data (including data dictionary), statistical code and any other materials can be accessed	128
Funding and conflicts of interest	5a	Sources of funding and other support (eg, supply of drugs), and role of funders in the design, conduct, analysis and reporting of the trial	128
	5b	Financial and other conflicts of interest of the manuscript authors	128
Introduction			
Background and rationale	6	Scientific background and rationale	125 - 128
Objectives	7	Specific objectives related to benefits and harms	128
Methods			
Patient and public involvement	8	Details of patient or public involvement in the design, conduct and reporting of the trial	130-131
Trial design	9	Description of trial design including type of trial (eg, parallel group, crossover), allocation ratio, and framework (eg, superiority, equivalence, non-inferiority, exploratory)	129-133 and appendix U
Changes to trial protocol	10	Important changes to the trial after it commenced including any outcomes or analyses that were not prespecified, with reason	n/a
Trial setting	11	Settings (eg, community, hospital) and locations (eg, countries, sites) where the trial was conducted	128-129 and appendix U
Eligibility criteria	12a	Eligibility criteria for participants	128-129
	12b	If applicable, eligibility criteria for sites and for individuals delivering the interventions (eg, surgeons, physiotherapists)	n/a
Intervention and comparator	13	Intervention and comparator with sufficient details to allow replication. If relevant, where additional materials describing the intervention and comparator (eg, intervention manual) can be accessed	130-132 and appendix Y
Outcomes	14	Prespecified primary and secondary outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to	133-134

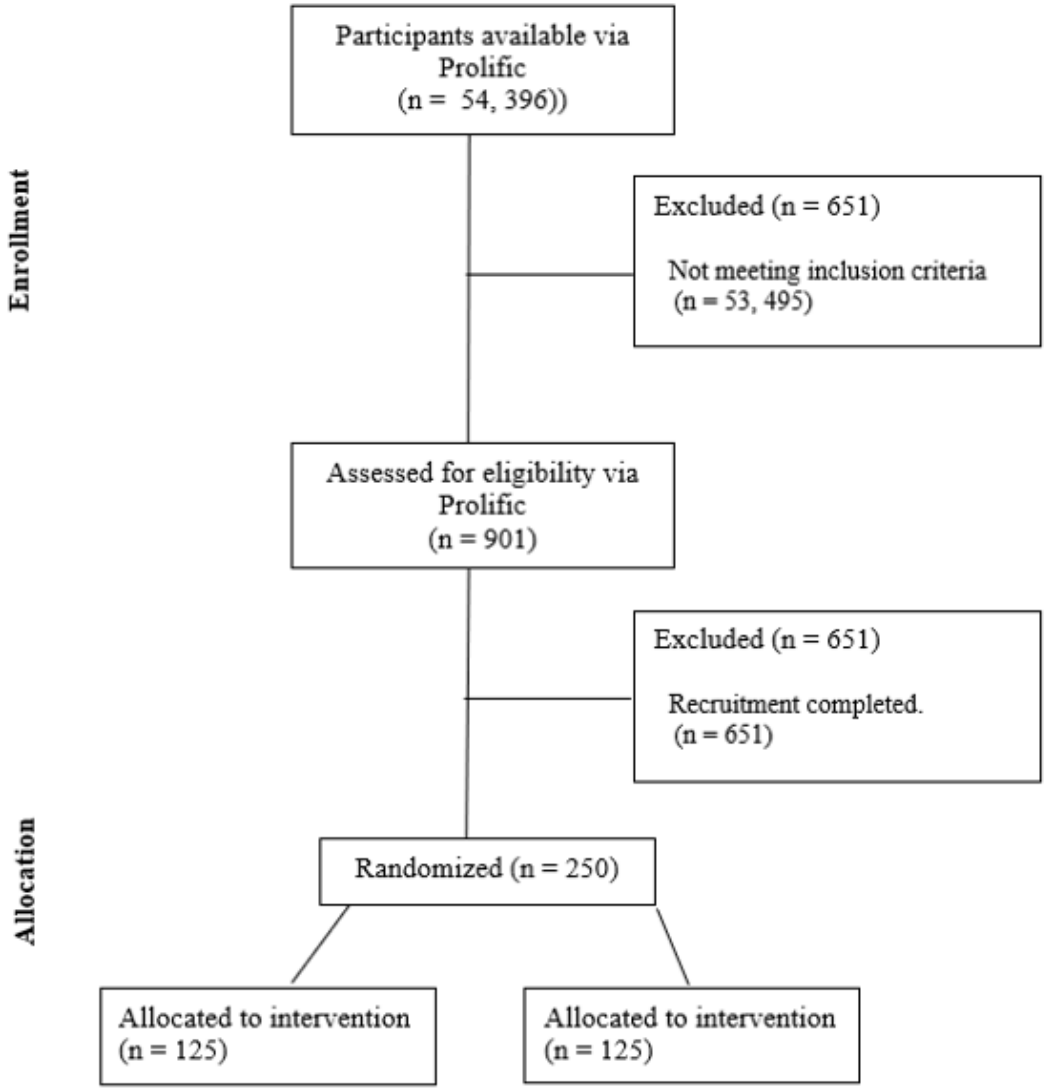
		event), method of aggregation (eg, median, proportion), and time point for each outcome	
Harms	15	How harms were defined and assessed (eg, systematically, non-systematically)	n/a
Sample size	16a	How sample size was determined, including all assumptions supporting the sample size calculation	129
	16b	Explanation of any interim analyses and stopping guidelines	n/a
Randomisation:			
Sequence generation	17a	Who generated the random allocation sequence and the method used	n/a
	17b	Type of randomisation and details of any restriction (eg, stratification, blocking and block size)	129
			Reported on page no.
Allocation concealment mechanism	18	Mechanism used to implement the random allocation sequence (eg, central computer/telephone; sequentially numbered, opaque, sealed containers), describing any steps to conceal the sequence until interventions were assigned	Appendix U
Implementation	19	Whether the personnel who enrolled and those who assigned participants to the interventions had access to the random allocation sequence	n/a
Blinding	20a	Who was blinded after assignment to interventions (eg, participants, care providers, outcome assessors, data analysts)	n/a
	20b	If blinded, how blinding was achieved and description of the similarity of interventions	n/a
Statistical methods	21a	Statistical methods used to compare groups for primary and secondary outcomes, including harms	133-134
	21b	Definition of who is included in each analysis (eg, all randomised participants), and in which group	
	21c	How missing data were handled in the analysis	134-135
	21d	Methods for any additional analyses (eg, subgroup and sensitivity analyses), distinguishing prespecified from post hoc	n/a
Results			
Participant flow, including flow diagram	22a	For each group, the numbers of participants who were randomly assigned, received intended intervention, and were analysed for the primary outcome	Appendix BB
	22b	For each group, losses and exclusions after randomisation, together with reasons	n/a
Recruitment	23a	Dates defining the periods of recruitment and follow-up for outcomes of benefits and harms	129
	23b	If relevant, why the trial ended or was stopped	n/a
Intervention and comparator delivery	24a	Intervention and comparator as they were actually administered (eg, where appropriate, who delivered the intervention/comparator, how participants adhered, whether they were delivered as intended (fidelity))	130 – 133, appendix Y & Z
	24b	Concomitant care received during the trial for each group	n/a
Baseline data	25	A table showing baseline demographic and clinical characteristics for each group	Appendix BB
Numbers analysed, outcomes and estimation	26	For each primary and secondary outcome, by group: ● the number of participants included in the analysis ● the number of participants with available data at the outcome time point ● result for each group, and the estimated effect size and its precision (such as 95% confidence interval)	Appendix BB

		● for binary outcomes, presentation of both absolute and relative effect size	
Harms	27	All harms or unintended events in each group	
Ancillary analyses	28	Any other analyses performed, including subgroup and sensitivity analyses, distinguishing pre-specified from post hoc	134 – 139
Discussion			
Interpretation	29	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	138 - 141
Limitations	30	Trial limitations, addressing sources of potential bias, imprecision, generalisability, and, if relevant, multiplicity of analyses	140 - 141

Citation: Hopewell S, Chan AW, Collins GS, Hróbjartsson A, Moher D, Schulz KF, et al. CONSORT 2025 Statement: updated guideline for reporting randomised trials. BMJ. 2025; 388:e081123. https://dx.doi.org/10.1136/bmj-2024-081123

*We strongly recommend reading this statement in conjunction with the CONSORT 2025 Explanation and Elaboration and/or the CONSORT 2025 Expanded Checklist for important clarifications on all the items. We also recommend reading relevant CONSORT extensions. See www.consort-spirit.org.

APPENDIX W. Randomised controlled trial Consort diagram



APPENDIX X. Randomised controlled trial demographic pre-intervention questionnaire

1. What is your Prolific ID?

Please note that this response should auto-fill with the correct ID

2. Have you previously attended your cervical cancer screening? (also known as a pap smear)

- Yes
- No

3. Have you ever been diagnosed with cervical cancer, had a hysterectomy procedure and/or had a positive pap smear result? (if applicable)

- Yes
- No

4. "Women in the UK are invited to attend a cervical cancer screening when they are 24.5 years old.

   Please answer the following question about your intention to attend or not."

   I intend to attend cervical cancer screening when I am invited. (scale -5 to 5)

5. Have you had the HPV vaccine?
   (This is a vaccine to protect against viruses that can cause cervical cancer. It is usually given in two doses (aged 12/13 or school year 8) or free for anyone under 25 years old)

- Yes
- No
- Not sure

6. If yes, how many doses of the vaccine have you received?

- One dose
- Two or more doses
- Don't know/not sure

7. “Below are a few demographic questions about you.”

   Ethnicity: “Please specify your ethnicity - select one category that you feel best represents your ethnicity”

- Asian or Asian British (*Indian, Pakistani, Bangladeshi, Chinese and/or Any other Asian background*)
- Black, Black British, Caribbean or African (*Caribbean, African and/or Any other Black, Black British, or Caribbean background*)
- Mixed or multiple ethnic groups (*White and Black Caribbean, White and Black African, White and Asian and/or Any other Mixed or multiple ethnic background*)
- White (*English, Welsh, Scottish, Northern Irish or British, Irish, Gypsy or Irish Traveller, Roma and/or Any other white background*)
- Other ethnic group (*Arab and/or any other ethnic group*)
    - Please specify further:_____

8. Gender: “What gender do you identify as?”

- Male
- Female
- Trans Male/Trans Man
- Trans Female/Trans Women
- Non-binary
- _____ (Short answer space)
- Prefer not to answer

9. Education: “What is the highest degree or level of education you have completed?”

- Left school without any qualifications
- GCSE
- A-level, National Diploma or equivalent
- Undergraduate degree
- Higher certificates (*including Advanced Apprenticeship/Diplomas*)
- Postgraduate degree (*including all master’s degrees*)
- PhD
- Other:_____

10. Relationship status: “What is your current relationship status?”

- Single
- Married
- Partnered
- Other

11. Religion: “What religion do you identify most with?”

- Catholicism/Christianity
- Judaism
- Islam
- Buddhism
- Hinduism
- Prefer not to say
- Not religious
- Other:_____

12. How would you rate your health status?

- Poor
- Fair
- Good
- Excellent

13. Do you have a longstanding illness, disability or infirmity that limits daily activities in any way, compared to people of the same age?

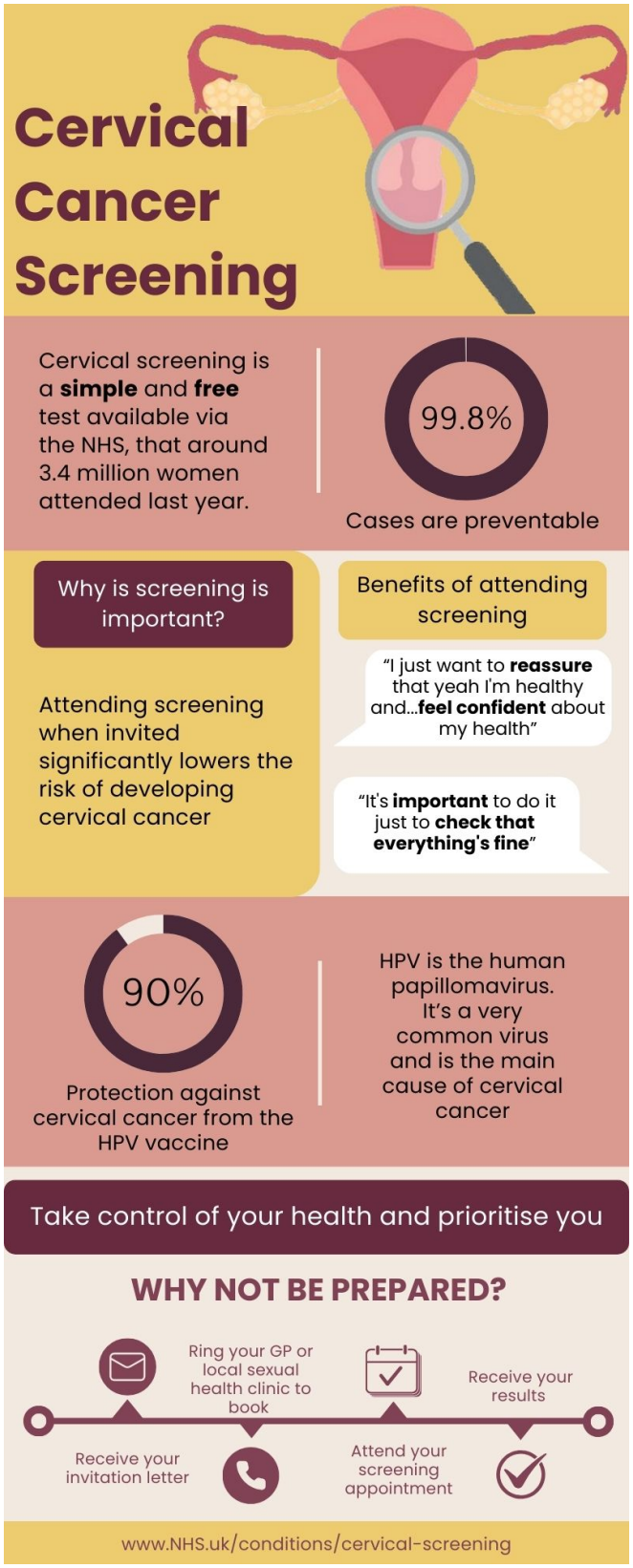
- Yes
- No

Prolific demographic data provided:

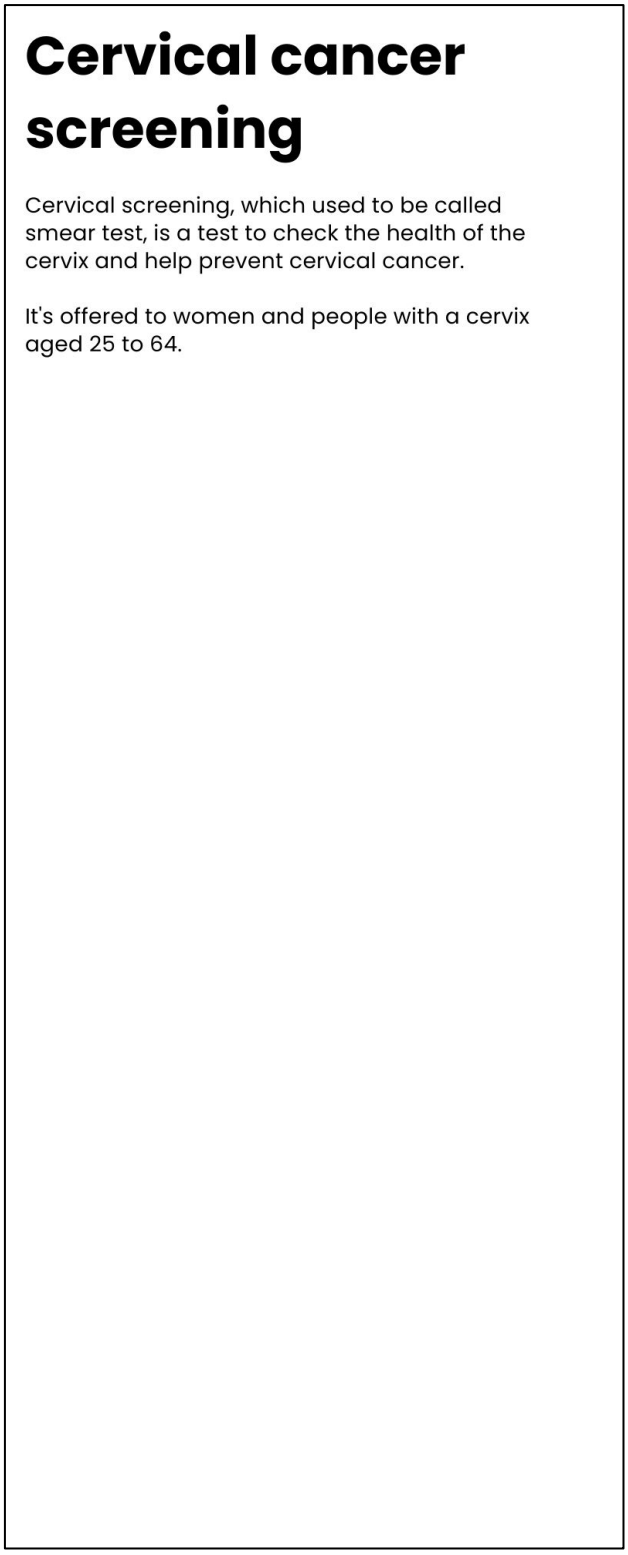
- *Session id*
- *Participant id*
- *Submission status*
- *Started date-time (in GMT)*
- *Completed date-time (in GMT)*
- *Time taken*
- *Age*

- *Sex*
- *First language*
- *Current country of residence*
- *Nationality*
- *Country of birth*
- *Student status*
- *Employment status*
- *Reviewed at date-time (in GMT)*
- *Completion code ('entered code')*

APPENDIX Y. Randomised controlled trial intervention infographic



APPENDIX Z. Randomised controlled trial control infographic



APPENDIX AA. Randomised controlled trial post-intervention questionnaire

Infographic block

"You will now be shown some information about cervical screening in the form of an infographic. Please note that you will not have access to the infographic once you move on"

Participants are shown either an intervention infographic or a control infographic.

Reflective motivation block

"You will now be required to answer some final questions to complete your participation

Answer each question by using the slider to indicate your response."

Scale:

Strongly disagree - Strongly agree (rate -5 - 5 (10 response options)

"The next question asks about your motivation to attend cervical cancer screening when you are invited.

> (What is motivation? Conscious planning and evaluations (beliefs about what is good and bad, e.g. I have the desire to, I feel the need to) about cervical cancer screening)"

> I am motivated to attend cervical cancer screening.

- Cervical cancer screening is important
- I do not perceive myself to be at risk of cervical cancer
- I am no more at risk of cervical cancer than anyone my age
- I intend to attend my cervical cancer screening when I am invited
- I intend to attend my cervical cancer screening every time I am invited
- Cervical cancer screening is not a current priority for me
- I believe attending my cervical cancer screening is worthwhile
- I believe attending my cervical cancer screening will benefit me

- I have had previous negative experiences with health-related screening or at the GP
- I will try to go for cervical screening when I am invited.

Engagement with the infographic

“Below are some questions about the infographic you viewed earlier in the survey.”

Scale:

Strongly disagree - Strongly agree (rate -5 - 5 (10 response options)

- How unengaging or engaging did you find the information about cervical screening?
    - Not engaging - engaging
- How unappealing or appealing did you find the information about cervical screening?
    - Unappealing - Appealing
- How unpleasant or pleasant did you find the information about cervical screening?
    - Unpleasant - Pleasant
- How boring or interesting did you find the information about cervical screening?
    - Boring - Interesting
- How hard to understand or easy to understand did you find the information about cervical screening?
    - Hard - Easy
- How uninformative or informative did you find the information about cervical screening?
    - Uninformative - Informative
- How ineffective or effective did you find the information about cervical cancer screening?
    - Ineffective - Effective
- How much of the infographic did you read?
    - 0 - 100%

APPENDIX BB. Randomised controlled trial summary of participant demographics

Characteristics		**Intervention (n = 125)**	**Control (n = 126)**	**Total**	**Chi-square**	***p***
		n (%)	**n (%)**	**n (%)**		
Gender					0.515[a]	.678
	Female	119 (95)	122 (97)	241 (96)		
	Prefer self-identify	2 (2)	3 (2)	5 (2)		
	Prefer not to say**	4 (3)	1 (1)	5 (2)		
Ethnicity					0.052	.820
	White British or White Other	86 (69)	85 (68)	171 (68)		
	Other	39 (31)	41 (33)	80 (32)		
Place of residence					0.225	.635
	England UK	104 (83)	102 (81)	206 (82)		
	Scotland, Northern Ireland and Wales	20 (16)	23 (18)	43 (17)		

	Missing	1 (1)	1 (1)	2 (1)		
Education					0.650	.420
	Higher education	96 (77)	102 (81)	198 (79)		
	School-level education	29 (23)	24 (19)	53 (21)		
Relationship status					2.948	.086
	Partnered	59 (47)	46 (37)	105 (42)		
	Not partnered/other	66 (53)	80 (64)	146 (58)		
Religion					0.607	.436
	Not Religious	35 (28)	40 (32)	75 (30)		
	Religious	88 (70)	81 (64)	169 (67)		
	Prefer not say**	2 (2)	5 (4)	7 (3)		
Employment status					0.000	.986
	Employed	72 (58)	77 (61)	149 (59)		
	Not Employed	16 (13)	17 (14)	33 (13)		
	Missing**	37 (30)	32 (25)	69 (28)		

Longstanding illness, disability or infirmity that limits daily activities						0.497	.481
	No	102 (82)	107 (85)	209 (83)			
	Yes	23 (18)	19 (15)	42 (17)			
HPV vaccinated						2.17	.141
	Yes	105 (84)	101 (80)	206 (82)			
	No	8 (6)	15 (12)	23 (9)			
	Not sure**	12 (10)	10 (8)	22 (9)			
Number of doses						0.026[a]	.03*
	Two or more	66 (52.8)	76 (60.3)	142 (56.6)			
	One	7 (5.6)	1 (0.8)	8 (3.2)			
	Don’t know/not sure**	52 (41.6)	49 (38.9)	101 (40.2)			
		Mean (SD)	**Mean (SD)**	**Mean (SD)**	***df***	***t***	***p***
Health status					249	0.194	.989
		2.87 (0.70)	2.89 (0.68)	2.88 (0.70)			

Pre-intervention Intention					249	-1.995	.009*
	3.80 (1.94)	3.23 (2.54)	3.51 (2.78)			

Note. * p < .05. **Don't know/Not sure/Missing responses were excluded from final analyses. [a] Fisher's exact test was used due to low expected cell frequencies