

The question-behaviour effect in risk behaviours

Sarah Elizabeth Wilding

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The candidate confirms that the work submitted is her own, except where work which has formed part of jointly-authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

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Abstract

The question-behaviour effect (QBE) refers to the finding that asking individuals questions about their cognitions and/or behaviour or to predict future behaviour, can influence subsequent behaviour performance. Health risk behaviours are those behaviours that should be discouraged to produce favourable health outcomes such as smoking, excessive alcohol use and unhealthy eating. The current thesis aimed to investigate the influence of the QBE over health risk behaviours. It provides an original contribution to the literature in its focus on the QBE in these types of health behaviour. A comprehensive systematic review of the QBE literature demonstrated a small, significant effect of the QBE in general, however only 16 previous studies had been conducted investigating health risk behaviours and the majority of these focused on assessing behaviour at baseline. These previous studies produced a non-significant reduction in health risk behaviours as a result of the QBE. The systematic review identified a number of moderators of the QBE including setting.

Seven empirical studies are presented here, conducted in a range of settings (field, online, and lab). The data presented show mixed evidence of the QBE for risk behaviours. A mini meta-analysis of the studies presented demonstrated an overall small and non-significant effect of the QBE on risk behaviours. The individual studies demonstrated that the QBE has the potential to increase and reduce these behaviours. Three lab studies demonstrated an increase in unhealthy snacking as a result of questioning intentions relating to behaviour. This was also supported in one of the online studies, where smoking tended to be greater in individuals questioned on this behaviour compared to control, although the difference in conditions was not significant in all measures of behaviour. However one online study demonstrated a significant reduction in multiple health behaviours (risk and protection), when the QBE was combined with a dissonance manipulation.

The QBE has the potential to have a small influence over health risk behaviours and the studies presented here demonstrate that asking about these behaviours has the potential to increase them. The QBE may need to be combined with further manipulation focusing on motivation or dissonance to reduce these behaviours consistently.

Table of Contents

Acknowledgements.....	iv
Abstract.....	v
List of included tables	x
List of included figures	xi
Chapter 1 Introduction.....	12
1.1 Brief history of the QBE	12
1.2 Mechanisms of the QBE	15
1.2.1 Attitude accessibility	15
1.2.2 Cognitive dissonance	16
1.2.3 Processing fluency	16
1.3 Health Behaviours	17
1.3.1 The QBE in health behaviours.....	18
1.3.2 The QBE in health risk behaviours.....	19
1.3.3 Multiple health behaviour change	21
1.4 Thesis overview	22
1.4.1 Overview of chapters.....	22
Chapter 2 Literature review and meta-analysis of the influence of questioning on cognitions and behaviour	25
2.1 Introduction.....	25
2.2 Review Aim	29
2.3 Method	29
2.3.1 Eligibility criteria:.....	29
2.3.2 Literature searching:	32
2.3.3 Data extraction.....	32
2.3.4 Study coding	33
2.3.5 Analysis	35
2.4 Results.....	35
2.4.1 Study characteristics	35
2.4.2 Effect size	53
2.4.3 Area tested	53
2.4.4 Sensitivity analysis	53
2.5 Moderators	54
2.5.1 Population moderation effects	58
2.5.2 Significant population moderating effects.....	58

2.5.3	Non-significant population moderating effects.....	58
2.5.4	Question characteristics.....	59
2.5.5	Significant question moderators.....	59
2.5.6	Non-significant question moderators.....	60
2.5.7	Outcome characteristics.....	60
2.5.8	Non-significant outcome moderators.....	61
2.6	Methodology.....	62
2.6.1	Significant methodology moderators.....	62
2.6.2	Non-significant methodological moderators.....	63
2.6.3	Risk of bias.....	63
2.6.4	Decline in effect sizes.....	64
2.7	Multivariate analysis.....	65
2.8	Discussion.....	71
Chapter 3 A schools based investigation of QBE effects on adolescent smoking uptake: A cluster controlled trial.....		76
3.1	Study 1: School based interventions of the question-behaviour effect.....	76
3.1.1	Smoking.....	77
3.1.2	Study aims.....	78
3.1.3	Hypothesis:.....	79
3.2	Method.....	79
3.2.1	Participants.....	79
3.2.2	Measures.....	80
3.2.3	Design.....	81
3.2.4	Procedure.....	84
3.3	Results.....	85
3.3.1	Year 9 data.....	85
3.3.2	Year 11 data.....	86
3.4	Discussion.....	90
Chapter 4 Three online studies of the QBE in various health risk and health promotion behaviours.....		94
4.1	Introduction.....	94
4.1.1	Study aims.....	95
4.2	Study 2: Investigating QBE influences on specific unhealthy snacks.....	96
4.2.2	Method.....	98
4.2.3	Results.....	103
4.2.4	Discussion.....	106

4.3	Study 3: Investigating QBE influences in social smoking and social drinking	108
4.3.2	Methods	111
4.3.3	Results	117
4.3.4	Discussion.....	123
4.4	Study 4. The QBE in multiple protection and health risk behaviours	126
4.4.1	Focal behaviours.....	127
4.4.2	Dissonance.....	129
4.4.3	Self-monitoring.....	130
4.4.4	Aims.....	131
4.4.5	Method.....	132
4.4.6	Results	138
4.5	Discussion	141
4.6	General Discussion	143
	Chapter 5 Investigating the QBE in three lab based studies of healthy and unhealthy snacking.....	146
5.1	Introduction.....	146
5.1.1	Lab studies in health behaviours	148
5.1.2	‘Doing’ vs. ‘Not Doing’	148
5.1.3	Attitude Accessibility	149
5.1.4	Snacking behaviour	149
5.1.5	Aims.....	150
5.2	Shared Methods	151
5.2.1	Participants	151
5.2.2	Design.....	152
5.2.3	Procedure	152
5.2.4	Measures	153
5.3	Methods.....	154
5.3.1	Manipulations	154
5.4	Analyses	156
5.5	Results.....	157
5.5.1	Randomisation checks	157
5.5.2	Objective food choice	157
5.5.3	Snack diary	158
5.5.4	Total snacks consumed.....	161
5.5.5	Attitude accessibility	161

5.5.6	Self-monitoring.....	162
5.6	Meta-analysis	163
5.6.1	Condition effect on behaviour	165
5.6.2	Condition effect on attitude accessibility	165
5.6.3	Attitude accessibility effect on snacking behaviour	165
5.7	Mega analysis.....	167
5.8	General Discussion	167
Chapter 6 General discussion		171
6.1	Thesis aims.....	171
6.1.1	Gaps in the literature.....	171
6.2	Summary of studies conducted	172
6.2.1	Meta-analysis.....	175
6.2.2	QBE influences on risk behaviours	177
6.3	Moderators	178
6.4	Mechanisms	181
6.4.1	Attitude accessibility	181
6.4.2	Attitude ambivalence	182
6.4.3	Motivational or dissonance account	183
6.4.4	Processing fluency	185
6.5	Strengths and limitations of the work	186
6.6	Implications.....	189
6.6.1	Theoretical implications	189
6.6.2	Practical implications	190
6.7	Suggestions for future research.....	193
6.8	Conclusion	195
References		197
List of abbreviations		212
Appendices		213

List of included tables

Table 2.1 Full list of studies included in the review and the key information taken from each study.	36
Table 2.2 Subgroup analysis of QBE by behaviour	55
Table 2.3 Univariate and multivariate meta-regression analyses.....	66
Table 2.4 Moderator inter-collinearity matrix for significant moderators in the univariate meta-regression model.	70
Table 3.1 Descriptive statistics and frequency of smoking for QBE and control conditions in Year 11.	87
Table 4.1 Means (SD) for key dependent variables in snack and biscuit consumption in each condition.	105
Table 4.2 Means (SDs) for dependent variables in each condition.....	120
Table 4.3. Demographic Characteristics, and protection and risk DVs for Experimental and Control Conditions.....	140
Table 5.1. Means (SD) of outcome variables for conditions within studies 5-7.	160
Table 5.2. Meta-analysis of study results across dependent variable and snacking type	164
Table 5.3. Correlations between attitude accessibility measures and snacking dependent variables separated by study and then meta-analysed.	166
Table 6.1. Mini meta-analysis hedges g and 95% confidence intervals.	177

List of included figures

Figure 2.1. Inclusion/exclusion flow diagram.	31
Figure 3.1 Measures taken for year 9 and year 11 data	83
Figure 4.1. CONSORT flow diagram for study 2.	100
Figure 4.2. CONSORT flow diagram for study 3	113
Figure 4.3. CONSORT flow diagram for study 4.	134

Chapter 1 **Introduction**

Reported in this thesis is an investigation of the effect of measuring cognitions and behaviour on subsequent performance of health risk behaviours. Currently more than three quarters of deaths before age 75 are a result of cancer, heart disease, stroke, respiratory diseases and liver disease (NHS Live Well, 2014). In addition to this, Cancer Research UK suggest that just under half of cancer cases could be prevented through lifestyle changes such as not smoking, maintaining a healthy body weight, alcohol reduction, having a healthy balanced diet, keeping active, avoiding infections, and sun safety (Cancer Research UK, 2015). According to the Centre for Disease Control and Prevention (CDC, 2014), in the USA, 20-40% of morbidity could be prevented through healthy lifestyle choices. There is an unmet need for brief and low cost interventions that have the potential to be scaled up to target a large percentage of the population.

Answering questions relating to a behaviour has been shown to alter subsequent performance of that behaviour. This finding has been referred to by many names including “self-erasing nature of errors of prediction,” “self-prophecy” and “mere measurement” effects. More recently it has been referred to as the *question-behaviour effect* (QBE). This term encompasses all the different forms of questioning whether this relates to predictions of behaviour, behavioural intentions or other cognitions (Spratt, 2003). The QBE is a brief and low resource intervention which has the potential to be used as a large scale public health intervention to modify the unhealthy lifestyle patterns that are related to greater mortality and morbidity in developed countries. This chapter aims to provide a general introduction to this area of research, it highlights the questions that still remain in this area, and provides a more specific overview of the thesis.

1.1 Brief history of the QBE

In the seminal paper in this area, Sherman (1980) was the first to report the finding that answering behaviour related questions can produce a subsequent change in behaviour. He used the term “self-erasing nature of errors of prediction” to describe the finding that when American college students were asked to predict their likelihood of performing specified behaviours, they were inaccurate in their predictions where they

tended to overestimate how compliant with the behavioural request they would be. For example participants were asked whether they would agree to volunteer their time for a cancer charity. When the individuals asked to make this prediction were subsequently requested to perform the predicted behaviour it was found that in the prediction condition they were more likely to act in a way that was consistent with their over-prediction. More of those in the prediction condition agreed to volunteer their time than those in a non-questioned control condition.

This work subsequently gave rise to two separate strands of research carried out in parallel that focused on different forms of questioning and different behavioural domains: mere measurement and self-prophecy. Mere measurement research relied on the premise that forming and reporting a response to survey questions, typically relating to purchase intentions, can alter future behaviour (Morwitz, 1993). The majority of evidence supporting mere measurement effects has been in consumer behaviour (see Morwitz, 2007 for a review of this area). Asking intention questions such as “Do you or does anyone in your household plan to acquire a/another personal computer in future for use at home?” reported on a Likert scale, has been shown to increase the likelihood of making future purchases (Chandon, Morwitz, & Reinartz, 2004) and has also been demonstrated to increase specific brand purchase likelihood (Janiszewski & Chandon, 2007). A smaller number of mere measurement studies have focused on areas outside of consumer behaviour. These studies have used the same intention style questions but have investigated health behaviours including flossing (Levav & Fitzsimons, 2006), Pap Smear test attendance (Sandberg & Conner, 2009), and blood donation (Godin, 2008, 2013).

A second area of research was carried out in parallel to mere measurement studies and uses the term self-prophecy to refer to the investigation of the impact of making self-predictions relating to socially desirable behaviour, such as voting (Spangenberg & Sprott, 2006). Rather than using the Likert scale of intention typically found in mere measurement studies, participants are given a dichotomous choice selecting that they either will or will not perform a specified behaviour (e.g., Do you predict (a) you will not participate in a health and fitness assessment, (b) you will participate in a health and fitness assessment). Research has demonstrated that self-prophecy can be used to increase health behaviours such as acceptance of a Hepatitis B (HBV) vaccination, where self-prediction of behaviour increased this behaviour (from 32.6% in a control group to 55%) in individuals who had high levels of perceived discomfort to receiving

the vaccination (Cox, Cox, Cyrier, Graham-Dotson, & Zimet, 2012). Self-prophecy has also been demonstrated to increase non-health behaviours like voting (Greenwald, 1988) and donating money to a University (Obermiller, 2000). A meta-analysis of a small number of self-prophecy studies reported a small to medium effect on behaviour ($Z_r = .26$, $k = 7$; Sprott, Spangenberg, Knuff, & Devezer, 2006).

These two areas of research were typically investigated with very little crossover. In 2006 Sprott et al. were the first authors to suggest that both these research areas were investigating a similar or connected phenomenon. They suggested that both areas should be considered under the same general term of the *question-behaviour effect*. They defined the question-behaviour effect as “any phenomenon where questioning (through intention measure, self-prediction, satisfaction measure, or other means) influences future performance of behaviour” (p. 129). Subsequent reviews and research have continued to use this term and it is common for studies using either term (self-prophecy and mere measurement) to be included in the same literature review or meta-analysis. This definition also includes an additional area of research that was not covered in previous reviews by Dholakia (2010), Sprott et al. (2006) or even by recent reviews of the literature (e.g., Wood et al., 2016; Spangenberg et al., 2016): measurement reactivity. This refers to the finding that the measurement of behaviour can produce a change in behaviour combined with or even beyond that of an intervention.

Research in the assessment reactivity literature has differed to the two areas mentioned previously in that it has generally not been the main focus of studies. Instead, the assessment reactivity literature has typically investigated whether measuring behaviour at baseline as part of a behaviour change intervention, can change behaviour regardless of the effects of the intervention itself (McCambridge & Kypri, 2011). Studies in this area have often used a Solomon group design, where three or four conditions are used, two of which are not given the active intervention and instead are only assessed at baseline and follow up, or at follow up only. This has been investigated in a range of behaviours including physical activity in students (Spence, 2009) and alcohol use (e.g., Bendtsen et al., 2012).

Recently, despite the suggestion by Sprott et al., (2006) to unify research by using the term ‘question-behaviour effect’ to refer to a range of different study types the terms ‘mere measurement’ and ‘self-prophecy’ continue to be used interchangeably. For example a recent study used the term ‘self-prophecy’ and assessed the effect of self-

predictions of consumer behaviour in regards to purchasing environmentally friendly cleaning products (Bodur, Duval, & Grohman, 2014). One of the key benefits of including all research under the term 'QBE' is that it allows a broader assessment of these related areas of research and allows the assessment of similarities and differences (Dholakia, 2010) between the areas along with a consolidation of the overall areas to develop both general and specific understanding of the influence of questioning on behaviour. The current work therefore refers to the phenomenon of questioning intentions, other cognitions, assessing past behaviour and prediction of future behaviour, or satisfaction measures as the question-behaviour effect (QBE) throughout.

1.2 Mechanisms of the QBE

There have been a number of different mechanisms suggested to explain the existence of the question-behaviour effect. Three of the most consistently examined are: attitude accessibility, cognitive dissonance and processing fluency. Two of these mechanisms have been associated with the different streams of research, self-prophecy and mere measurement and therefore have received a great deal of attention. Mere measurement research has typically been associated with attitude accessibility as a mediator and self-prophecy research has been associated with cognitive dissonance. Finally processing fluency has been investigated in both areas of research. Each of these potential mechanisms will be now briefly described along with the current evidence for each mechanism.

1.2.1 Attitude accessibility

One of the potential mechanisms argued to underlie the question-behaviour effect is attitude accessibility. It is suggested that answering a question activates an individual's attitude relating to the focal behaviour. When the individual is then subsequently faced with the decision of performing the behaviour, they are more likely to act in accordance with their attitude than if they were not questioned, due to their attitude being more easily accessible in their memory. One study that supported this asked individuals to form attitudes about unknown candy bars and found if these attitudes were positive, individuals were subsequently more likely to choose to purchase the candy bars they had accessible positive attitudes toward (Morwitz & Fitzsimons, 2004).

Attitude accessibility was shown to mediate the question-behaviour relationship in a study focusing on healthy eating (Wood et al., 2014). Participants were asked to report

their intentions toward eating healthily in the next week and had the accessibility of their attitudes toward healthy food words assessed using a reaction time task. Attitude accessibility was indicated when participants in the intention condition responded more quickly to healthy snack words compared to a control condition. This attitude accessibility was found to mediate the relationship between condition and objective healthy snack choice. The two studies described here (Morwitz & Fitzsimons 2004; Wood et al., 2014) therefore provide support for attitude accessibility as a mechanism of the QBE when attitudes or intentions were measured as the QBE intervention.

1.2.2 Cognitive dissonance

The second mechanism suggested to underlie the QBE is cognitive dissonance. This has been investigated within the self-prophecy literature and suggests that asking individuals to make a prediction about their future behaviour reminds them about social norms and previous non-compliance with these norms (Dholakia, 2010). The act of questioning makes an individual more aware of inconsistencies between their perceived self and the personal standards of correct behaviour they hold. This can then result in them feeling dissonance, which is an aversive state (Aronson, 1992) that motivates the individual to change their behaviour in order to reduce the risk of this negative state (Elliot & Devine, 1994).

Dissonance is not something that is easy to measure and so previous studies that have tried to investigate this as a mechanism have often relied on manipulating related factors. One such example is self-affirmation, where individuals are encouraged to rank values and qualities as to the level of importance to them, which is thought to be related to reduce dissonance (e.g. Spangenberg, Sprott, Grohmann, & Smith, 2003). A number of studies by Spangenberg et al. (2003) showed that the act of predicting behaviour was found to be associated with greater levels of reported psychological discomfort and this was reduced when participants were exposed to a self-affirmation manipulation.

Otherwise dissonance has also been inferred by measuring related cognitions, such as social norms. One study found that self-prophecy had more of an influence on behaviours where participants rated that they had stronger compared to weaker normative beliefs relating to behaviour, including low-fat snack consumption and performing a health and fitness assessment (Sprott, Spangenberg, & Fisher, 2003).

1.2.3 Processing fluency

The third and final mechanism to have received attention in the QBE literature is processing fluency. Sherman (1980) suggested that the act of questioning activates behavioural scripts, which then increases the likelihood of the activated scripts turning into behaviour. This processing fluency mechanism has been investigated by Janiszewski and Chandon, (2007) where they referred to it as transfer-appropriate processing. They suggested that individuals are more likely to perform behaviour when they are better able to execute the cognitive processes that support considering the action. In a number of studies Janiszewski and Chandon (2007) attempted to compare attitude accessibility and processing fluency as mechanisms underlying the impact of assessing intentions on behaviour. They posited that attitude accessibility would not be able to underlie the relationship if there were no pre-existing attitudes toward the behaviours tested as they related to purchasing novel candy bars. In order to test the processing fluency mechanism they manipulated whether participants were previously asked about their intentions toward purchasing specific candy bars. Their group of eight experiments appeared to support response fluency and processing fluency as a mechanism that influences the mere measurement effect separately from attitude accessibility.

These three mechanisms suggested to underlie the QBE have received attention from both streams of literature, generally with studies within the mere measurement literature supporting attitude accessibility and processing fluency and self-prophecy research supporting cognitive dissonance. It may be the case that each of the different types of questioning works through a different mechanism. A recent review and meta-analysis by Wood et al. (2016) assessed the influence of each of these mechanisms. Whilst they found little evidence supporting cognitive dissonance or processing fluency, their results did provide support for attitude accessibility as a mechanism of the QBE.

1.3 Health Behaviours

Health behaviour is a key behavioural domain that has received particular attention in the QBE literature. Health behaviours typically have three functions: to prevent the onset of health problems (e.g., exercise, wearing condoms); detect the development of health problems (e.g., screening) or cure or treat an ongoing health problem (e.g., chemotherapy; Rothman & Salovey, 1997). Health damaging behaviours are also important. In 2014 NICE provided guidelines for individual targeted behaviour change

interventions that aim to change these behaviours with specific focus on five key behaviours: Poor dietary behaviour, alcohol misuse, physical inactivity, unsafe sex, and smoking. A great deal of evidence supports the view that changing people's health-related behaviour can have an impact on both mortality and morbidity. NICE guidelines from 2007 suggest that changing individual behaviour is likely to be easier than changing health inequalities or genetic predispositions which are suggested to be the three leading factors influencing mortality and morbidity.

Higgins (1997) suggested that people have two distinct sorts of goals in order to achieve a desired end state, such as positive health outcomes. Either aiming for a match with a desired end state or achieving the same end state through avoiding a mismatch with the desired end state. In terms of health behaviours, the positive end state would be good health. Based on Higgins (1997) this would suggest that this end state can be achieved through 'protection' focused behaviour, such as eating healthy foods or alternatively 'avoid' focused in avoiding risk behaviours, such as drinking to excess or smoking.

1.3.1 The QBE in health behaviours

This separation of health behaviours appears to be an important distinction in this area of research. The present work will refer to these differing categories of health behaviour as protection and risk behaviours. Protection health behaviours are those that should be performed in order to encourage a healthy lifestyle. This includes a wide range of different behaviours and the QBE has been applied to many of these including: healthy eating, attending general health screenings, vaccinations for flu and hepatitis B, along with physical activity. The QBE has been found to increase a range of health protection behaviours including flu vaccinations (Conner, Godin, Norman, & Sheeran, 2011) where receiving a mailed questionnaire based on the Theory of Planned Behaviour (Ajzen, 1991) increased vaccinations by 6%. A similar mailed questionnaire relating to blood donation also increased this behaviour over 12 month follow up by 6.4% (Godin, Sheeran, Conner, & German, 2008) and Pap smear attendance by 2.9% (Sandberg & Conner, 2009). Prediction questions have also been applied to protection health behaviours including flossing. Asking individuals whether they predict that they will floss over the next two weeks, increased the incidence of this compared to control by 34% (Levav & Fitzsimons, 2006).

However, not all the evidence in health protection behaviours has been positive. Despite evidence from studies conducted by Godin et al. (2008, 2015) that found blood donation was increased by the QBE, not all studies on blood donation have consistently found this result. van Dongen et al. (2014) provide a comparison between five randomised controlled trials testing the QBE in blood donation. They showed that in four of these five trials no overall increase in blood donation was found. This pattern may be due to some sort of response bias, where only motivated individuals will complete the questionnaire relating to blood donation and then the data show they are more likely to donate blood.

Health risk behaviours are those that should be discouraged in order to support a healthy lifestyle. Examples of risk behaviours include: reducing excessive alcohol consumption, stopping smoking and drug taking and consuming healthy snacks. The present work focuses on health risk behaviours. There has been some suggestion that the question-behaviour effect works differently in protection vs. health risk behaviours. One article by Fitzsimons and Moore (2008) suggested that asking people to predict future levels of these risk behaviours is likely to produce an increase rather than a decrease in behaviour. The QBE could therefore have a detrimental effect on health behaviours.

1.3.2 The QBE in health risk behaviours

The present work uses the term ‘health risk behaviours’, as defined above, this includes all behaviours that should be discouraged to produce favourable health outcomes. This includes risk taking behaviours, which have been defined as those that involve some potential for danger/harm but which also give the chance of a reward of some sort (Leigh, 1999). Not all of the behaviours investigated in the present work have a clear chance of reward (e.g., sedentary behaviour) however they are still associated with negative health outcomes and therefore should be avoided to promote a healthy lifestyle.

Moore and Fitzsimons (2008) provide an in-depth discussion of the potential reasons why applying the QBE to risk behaviours could produce an increase in behaviour. They suggest that the same key mechanisms proposed to underlie QBE: attitude accessibility and cognitive dissonance may also be underlying the QBE increasing risky behaviours. They also suggest that individuals often have mixed attitudes toward behaviours such as smoking and excessive alcohol consumption. For example they are aware that these

behaviours are unhealthy, yet simultaneously find them enjoyable (Lawton, Conner, & Parker, 2007). Moore and Fitzsimons (2008) therefore suggest that the more salient of these two competing attitudes is likely to be activated through questioning and this may subsequently produce a greater incidence of the behaviour rather than reducing behaviour. In addition to this, they suggest that if individuals have positive attitudes toward a risk behaviour, as may be the case in adolescent drinking, then cognitive dissonance may also work to increase these behaviours. If there is no negative dissonance associated with performing the behaviour the QBE subsequently may act to increase this behaviour. Fitzsimons and Moore (2008) use a study on illegal drug use by Williams, Block, and Fitzsimons (2006) to support their argument that the QBE has potential to increase health risk behaviours. This study has been subsequently criticised due to the use of inappropriate analyses (Schneider, Tahk, & Krosnick, 2008) and reanalysis showed no effect of the QBE on self-reported drug use. Thus, the evidence supporting the potential for the QBE to increase health risk behaviours is not conclusive.

Recent reviews also disagree with Fitzsimons and Moore's (2008) claims that the QBE increases health risk behaviours. Wood et al. (2016) separated behaviours into health, prosocial, consumer and undesirable/risky and found a small negative effect on undesirable/risky behaviours ($d = -.05$, $CI_{95} = -.23, .13$), suggesting a non-significant reduction of these behaviours. This was a similar pattern to a review of studies assessing Theory of Planned Behaviour (TPB; Ajzen, 1991) cognitions at baseline by Mankarious and Kothe (2015) who also found a small reduction in socially undesirable and risk behaviours. However both of these reviews have limitations in assessing the impact of the QBE on health risk behaviours. The review by Wood et al. (2016) did not separate risk behaviours into those that specifically focused on health risk behaviours. In addition to this the Mankarious and Kothe (2015) review only focused on prospective TPB studies, which are a very small proportion of studies in the QBE literature.

One factor suggested to influence the QBE in risk behaviours is the question framing used (Sherman, 2008; Gollwitzer, & Oettingen, 2008). Sherman (2008) proposed that studies which ask participants to report the frequency of their behaviour are likely to increase risk behaviours, dependent on the anchoring of the response scales as these may inadvertently bias participant responding to be greater than it is. In addition to this, Moore and Fitzsimons (2008) suggest that the specific behaviour that is questioned

might influence the level of change that is produced on subsequent behaviour, where they suggest that asking individuals about likelihood of eating fatty food is likely to have a different impact to asking about eating cookies, as the specific behaviour brought to mind is likely to have a different associated attitude.

A range of behaviours that could be considered to be health risk behaviours or risky have been the target of QBE studies. These studies have shown mixed findings. The majority of studies into the QBE and risk behaviours have focused on alcohol. Of thirteen studies focusing on alcohol, four were found to produce a significant reduction in behaviour and nine found no significant difference between experimental and control conditions. Twelve of these thirteen studies were within the assessment reactivity literature and assessed the influence of measuring behaviour at baseline on subsequently reported behaviour. Only one previous study assessed the impact of measuring Theory of Planned Behaviour cognitions on alcohol use. This produced a moderate reduction in alcohol use (Todd, 2011). All studies that found significant reductions focused on student samples (Kypri, 2007; McCambridge et al., 2007; Todd, 2011; Walters, 2009). However, a number of studies in similar samples found no significant effect of the questioning (Bendtsen et al., 2012; Carey, 2006; McCambridge, 2013; Moreira, 2012). The remainder of studies that found null effects used participants recruited in a health care setting (e.g., Cherpital, 2010; Bernstein, 2010; Richmond, 1995). This supports an unclear picture as to the impact of the QBE over health risk behaviours, therefore further research is justified.

1.3.3 Multiple health behaviour change

A further issue addressed in this thesis is the influence of the QBE over multiple health behaviours. As previously stated in this chapter, the four key modifiable health behaviours that relate to mortality and morbidity are: smoking, excessive alcohol use, the lack of physical activity and an unhealthy diet. These four behaviours are suggested to cluster together and therefore do not occur in isolation (Poortinga, 2007). In order to understand the influence of the QBE over health risk behaviours, it is important to explore QBE influences over multiple behaviours within the same study.

Only one previous study has investigated the QBE across multiple health behaviours. Lawrence and Ferguson (2011) investigated the impact of assessing intentions and past behaviour in relation to quitting cigarette smoking, reducing alcohol use, performing safe sex, driving safely, dieting, and exercising. This study found only one significant

effect, where alcohol consumption was reduced at follow up in the experimental group compared to a control.

1.4 Thesis overview

Due to the limited research investigating the influence of asking questions on subsequent health risk behaviours, more research is needed to assess the QBE in a range of health risk behaviours in different populations using a range of different questioning techniques. This would help to extend our knowledge of the potential applicability of QBE interventions.

The overall thesis aim is to investigate the influence of the QBE over risk behaviours, along with potential moderators of the effect. It also aims to provide an investigation of cognitive dissonance and attitude accessibility as potential mediators of the QBE. There were four key research questions this work aimed to address. These were: (a) whether the QBE can be applied as a method to reduce risk behaviours, (b) if not (a) then whether the QBE increases these risk behaviours, (c) what moderators influence the QBE including the most appropriate forms of questioning to use in relation to health risk behaviours.

A recommendation from NICE (2014) is that interventions should use objective, validated measures of behaviour along with providing mechanisms of action to understanding why the intervention is effective. The studies reported in this thesis employed objective, validated measures of behaviour where possible and investigated the mechanisms of change. The aims of this thesis will be addressed through field studies, where the QBE would likely be applied and lab based studies in order to develop a better understanding of the impact of manipulating specific characteristics relating to the intervention itself.

1.4.1 Overview of chapters

Chapter 2 will provide a systematic review of the general QBE literature. It will have a broader inclusion criteria than previous reviews in this area (Rodrigues et al., 2015; Wood et al., 2016; Spangenberg et al., 2016) and therefore should provide a comprehensive picture of the influence of questioning of cognitions or behaviour. The key aims of the systematic review are: (1) to provide an effect size estimate of the influence of questioning of cognitions and/or behaviour and the influence of this on subsequent cognitions and/or behaviour- including health risk behaviours, (2) to better

understand the influence of different methodological moderators on the influence of the QBE.

Chapters 3-6 provide empirical evidence investigating the QBE, these three chapters will all investigate study setting as a broad moderator across studies. Chapter 3 aims to assess the impact of questioning and assessment as a method of reducing smoking initiation in adolescent school children in Leeds. A field study is reported which compares the influence of assessing self-reported and objectively measured smoking on five occasions from age 11-16. This is compared against a control group that were only assessed for smoking levels in year 11 (age 15-16): The primary aim of this study was to investigate whether assessing smoking levels could be used as a potential method of reducing the number of adolescents who commence smoking in adolescence.

Chapter 4 reports three online studies of the QBE investigating the influence of a range of different questioning types on different health risk behaviours. The three studies also examined the influence of dissonance, this is assessed in studies 2 and 3 and manipulated in study 4. The first study tested the effect of asking individuals to predict future performance of a specific health risk behaviour, reducing biscuit consumption. Study 3 used a similar set of prediction questions to test the effect of making predictions on subsequent social smoking and drinking over one month follow up. The third study presented in Chapter 4 (study 4) tested the influence of measuring multiple cognitions on six different health behaviours: three health promotion behaviours and three health-risk behaviours. In Study four, cognitive dissonance was manipulated to assess whether this would enhance the effect of questioning alone.

Chapter 5 aimed to pick apart the influence of question wording as a specific moderator of the QBE through three lab studies that focused on healthy and unhealthy snacking. These three studies investigated the impact of assessing behavioural intentions in relation to healthy snacking and unhealthy snacking as protection and risk alternatives to a single health behaviour. The studies also examined whether questions framed as 'doing' or 'not doing' behaviour would produce a different effect on behaviour.

Chapter 5 also investigated mechanisms. Attitude accessibility was assessed as a potential mechanism in all three studies. Public commitment was also tested in study 3. The results of these three studies were also combined into a meta-analysis along with a mega-analysis in order to reduce the potential issues with low power of individual lab studies.

Finally, Chapter 6 provides a general discussion of the studies included in this thesis and what this suggests for future research in the area. The work will be discussed in terms of two key contributions to understanding within the QBE literature. First, the present work is discussed in terms of the potential for the QBE to be used as a method of changing health-risk behaviours. Secondly, the work is discussed in terms of the potential unintentional effects of questioning cognitions or behaviour on subsequent behaviour. The individual studies in the present work will also be subjected to a meta-analysis to better understand the contribution of this group of studies to the literature regarding the QBE and health risk behaviours, along with an assessment of the potential moderators as supported in Chapter 2, including study setting. Finally it will discuss limitations of the present work along with providing some suggestions for potential future research.

Chapter 2 **Literature review and meta-analysis of the influence of questioning on cognitions and behaviour**

2.1 Introduction

To date there have been a number of strands of research that have investigated the influence of questioning on behaviour. These have varied in a number of ways, from the type of questions used to the behavioural focus and type of design. This chapter will provide a comprehensive review of the question-behaviour effect literature. Its primary aim is to assess the overall impact of the QBE. Secondly it will also assess the impact of a range of methodological moderators on the question-behaviour effect to better understand what methodological factors have the greatest influence on the QBE.

There have been a number of reviews of the question-behaviour effect literature in the past decade and four reviews with meta-analytic components have been conducted fairly recently. The contribution of each of these will now be discussed, along with a description of how the present review aims to fill any gaps in knowledge that remain despite the contributions of previous reviews. In the past decade narrative reviews have been carried out to provide a consolidation of the self-prophecy and mere measurement literature (Sprott et al., 2006) and discuss potential moderators and mediators of the effect (Dholakia, 2010). However, these older reviews of the QBE did not use meta-analytic techniques, so provide a limited picture of the size of effect that the QBE has on behaviour as well as the impact of different moderators.

More recently, four reviews including meta-analysis have been conducted. These have varied in the types of studies included in terms of the question focus within the QBE literature, the study design, and the range of different moderators that have been assessed. Rodrigues et al. (2015) reviewed the QBE in randomised controlled trials (RCTs) focused on health behaviours. This meta-analysis found a small, significant effect of the QBE on 33 included studies, Cohen's $d = .09$, 95% CI [.04, .13]. Type of measure (cognitions or behaviour) and delivery method (questionnaires or interviews) were not supported as moderators of the effect.

Another recent review assessed the impact of measuring the Theory of Planned Behaviour in prospective studies on subsequent performance of health behaviour

(Mankarious & Kothe, 2015). This study found a non-significant negative influence of measuring the Theory of Planned behaviour, $d = -.03$, 95% CI [-.04, .11], suggesting that assessing intentions produced a small reduction in behaviour. Length of time interval and type of behaviour moderated the effects. Specifically, stronger effects were detected in studies with a longer term follow up and while there was no effect on desirable behaviours (e.g., physical activity), there was a small decrease in undesirable behaviours (e.g., binge drinking), $d = -.28$, 95% CI [-.37, -.18].

Wood et al. (2016) and Spangenberg et al. (2016) both provide fairly comprehensive reviews that cover a range of health and consumer behaviours and investigate mechanisms and moderators of the QBE. Similar to the Rodrigues et al. (2015) review both of these reviews also found a small significant effect of the QBE in 55 studies and 116 tests of the effect Wood et al., (2016; $d = .24$, 95% CI = .18, .30), and 51 studies including 104 tests (Spangenberg et al., 2016; $d = .28$, 95% CI = .24, .32). Wood et al. (2016) also assessed the support for the three key mechanisms of the QBE described in section 1.2: attitude accessibility, cognitive dissonance and processing fluency. They found little evidence to support any of these mechanisms, although there was a significant association between attitude accessibility and the QBE the heterogeneity explained by this was small. Their review did find a greater QBE in more socially desirable behaviours, easier behaviours, and in student samples.

The finding that the QBE produced a positive effect in socially desirable behaviours, as supported by Wood et al. (2016) contrasts with the findings from Mankarious and Kothe (2015) who found no effect on these behaviours. One potential explanation for this is that the two reviews used different methods of rating socially desirable behaviours. Wood et al. (2016) rated each study individually on a five point scale as to how much raters considered that the specific sample in each study would think that others would want them to perform the behaviour. Mankarious and Kothe (2015) used a simpler ranking method where behaviours were categorised as either socially desirable or undesirable, dependent on whether behaviour had any positive outcomes for an individual. Whilst Wood et al. included a wide variety of different studies that investigated the influence of asking prediction or intention questions on behaviour, Mankarious and Kothe only focused on a smaller number of studies that measured Theory of Planned Behaviour variables. It is likely that there is little overlap between the studies included in these two reviews since one of the key inclusion criteria in the Wood et al. review was that studies included terms that have been commonly used to

refer to the question-behaviour effect. This was not something that was considered key in the Mankarious and Kothe review which instead focused their search strategy on studies that had measured TPB variables at baseline and then followed participants up. These four reviews (Mankarious & Kothe, 2015; Rodrigues et al., 2015; Spangenberg et al., 2016; Wood et al., 2016) collectively support a small, significant effect of the QBE on health behaviours and the two most recent reviews (Spangenberg et al., 2016; Wood et al., 2016) both included non-health behaviours and provided support for a small increase in these behaviours as a result of questioning. However, there are limitations to the breadth of studies included within each of these reviews which produces a somewhat narrow picture of the influence of questioning on cognitions or behaviour. Both Wood et al. (2016) and Spangenberg et al. (2016) included all tests of the QBE provided they included some mention of keywords related to the question-behaviour effect. However this strategy could produce some limitations. Firstly their inclusion of multiple tests from the same study has potential to exaggerate the impact of the QBE by including multiple results from the same studies. Also, by limiting studies to those that use terms relating to the question-behaviour effect, this reduces the inclusion of studies to those that measure either intentions or self-predictions of behaviour. Only the review by Rodrigues et al. (2015) included this assessment reactivity literature in their review.

The literature review presented in this chapter aims to be the most comprehensive review to date of studies carried out on the QBE literature along with the methodological moderators of the effect. It aims to fill gaps in the literature that remain despite the recent interest in reviewing the literature. The present review extends previous literature by systematically reviewing and meta-analysing the findings of a greater variety of studies and investigates the influence of a number of methodological moderators that have not previously been analysed. Rather than limiting inclusion to studies testing the impact of prediction or intention questions on behaviour (Wood et al., 2016; Spangenberg et al., 2016) or RCTs in health behaviours (Rodrigues et al., 2015), the present review aims to include all studies that investigate the influence of assessing cognitions and/or behaviour at baseline and assesses the influence of this at follow up. This aims to produce a clearer picture of (a) the overall impact of the QBE and (b) the sorts of moderators that influence the question-behaviour effect.

The review will consider five types of moderators: (1) sample characteristics, (2) characteristics of the intervention, (3) outcome measures, (4) methodological factors, and (5) risk of bias.

(1) Sample characteristics include the types of sample used and the setting that studies are based within. While it is common in psychology studies to rely on student based samples within a lab based University setting, in order to assess the applicability of the question-behaviour effect as a method of changing behaviour it needs to be assessed within a range of different samples. Foot and Sanford (2004) suggest that students may differ cognitively from other samples and also are likely to have differing motivation, and may be more likely to complete questionnaires honestly and rationally. QBE studies have varied in their use of samples taken from community settings along with patients in a healthcare setting. Comparing across these different sample types and settings provides a better understanding of the potential applicability beyond a student sample and across settings.

(2) Intervention characteristics to be considered include the type of question (e.g., prediction, intention, past behaviour measure), and whether the questions were based on the Theory of Planned Behaviour (Ajzen, 1991). Along with the correspondence between question and behaviour, (i.e., whether both the question and behaviour focus on testing cognitions or behaviour), whether the specific question and behaviour are matched on their target, action, context and time.

(3) Factors relating to the target outcomes are also likely to have an impact over the size of QBE produced. For example the ease in which behaviour can be performed is likely to impact the influence that questioning will have. It is expected that behaviours that are easy to perform due to requiring a low level of effort such as making a one-time choice of healthy snack (e.g., Levav & Fitzsimons, 2006; Sprott, Spangenberg, & Fisher, 2003) would be easier to influence through questioning than moderately difficult behaviour such as attending screening (e.g., Sandberg & Conner, 2009; Cox et al., 2012) or donating money to charity (e.g., Sherman, 1980; Obermiller, 2000). This also includes separating behaviour in a number of ways including outcome type (e.g., health vs. consumer, protection/ risk), along with other behavioural factors (e.g., experience with behaviour, level of normative influence on behaviour, directedness of behaviour). This also includes the separation of health behaviours into protection and risk health behaviours, a distinction which is key to this thesis (see section 2.5.3.1).

(4) Methodological factors include self-reported behaviours or cognitions measured over the short term to objectively measured behaviours measured over a longer term and outcome measurement type (subjective/objective) to develop a clearer picture of the types of measure that are influenced most by exposure to questioning.

(5) Risk of bias was considered to explore whether the results are attributable to the manipulation rather than unintended factors stemming from poor study quality.

2.2 Review Aim

The present review aims to extend the knowledge gained from previous reviews by applying broader inclusion criteria to what has been used previously. It aims to provide a comprehensive review of all of the different research strands that make up question-behaviour effect research. In doing this, it will review studies that have investigated the impact of assessing cognitions/behaviour on cognitions/behaviour, including all types of participant and all designs. The review also aims to investigate the key methodological moderators that impact the influence that questioning has on cognitions and behaviour.

2.3 Method

The protocol for the present review was pre-registered on PROSPERO; full details of this are available in Appendix A and at

http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42014006595.

2.3.1 Eligibility criteria:

To be included in the review, studies had to meet all of the following criteria: (a) at least one group of participants were questioned on cognitions and/or behaviour before follow-up, and (b) at least one group of participants were not questioned on cognitions and/or behaviour before follow-up, and (c) there was a measure of cognitions and/or behaviour at follow up in both ‘intervention’ and comparison groups.

Studies were excluded if (a) a non-human sample was used, (b) the paper was an existing review, (c) the paper was a commentary on the effect, (d) the main intervention involved multiple measures of behaviour over multiple occasions (i.e., self-monitoring of behaviour), (e) either the non-measured condition or the intervention condition was

subjected to an alternative intervention not given to the other condition, (f) the paper was a dissertation, an abstract only or a book chapter, or (g) the paper was not published in the English language. Figure 2.1 shows the flow diagram of article inclusion (PRISMA group, 2009).

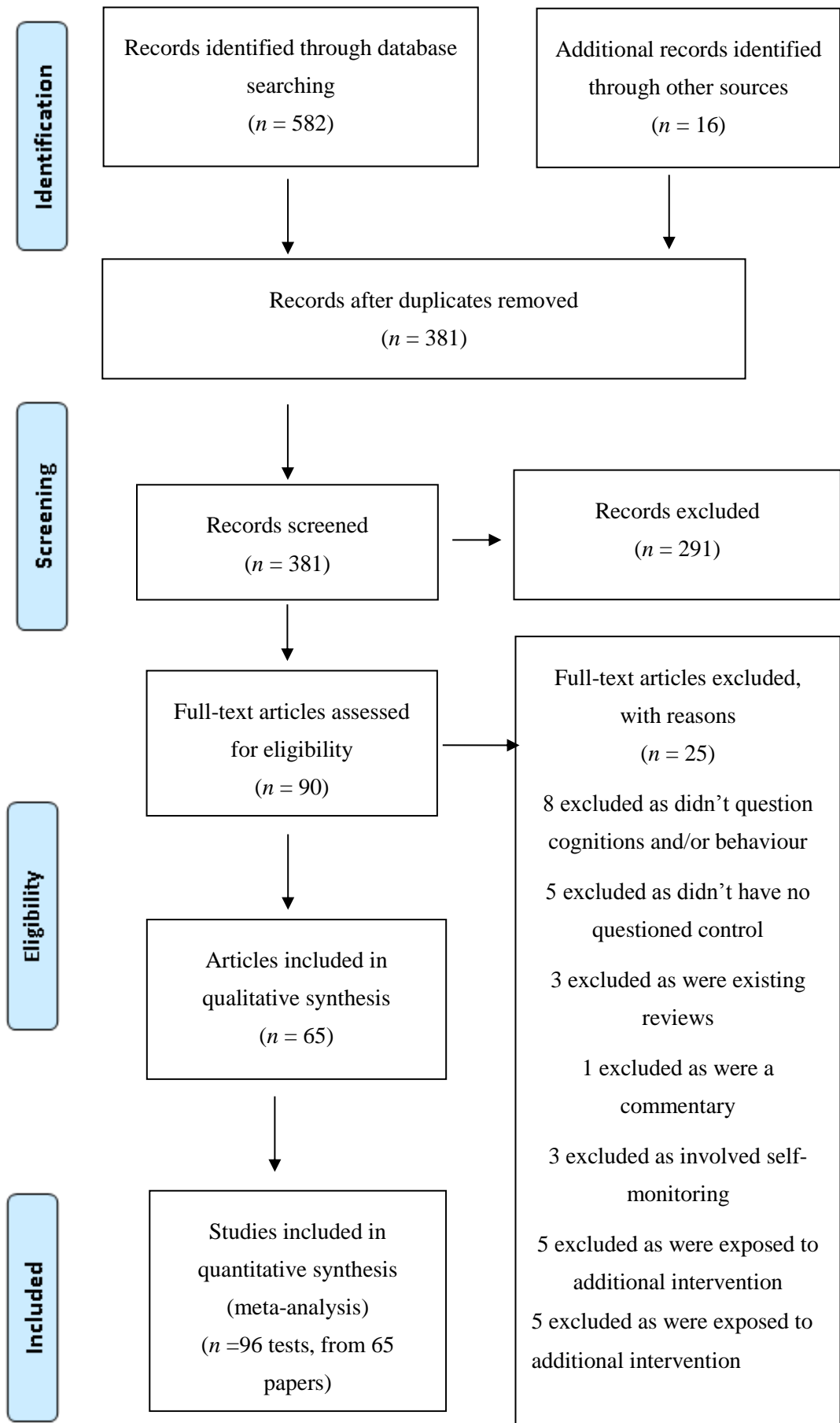


Figure 2.1. PRISMA inclusion/exclusion flow diagram.

2.3.2 Literature searching:

PsycINFO 1806-February 2015, MEDLINE 1946-February 2015 and EMBASE 1946-February 2015 were searched using OVID for articles published between 1980 (when the first study of the QBE was published: Sherman, 1980) and February 2015. The full list of search terms is available in Appendix A2. To supplement database searching, the reference lists of identified studies were examined along with those of recent reviews (Dholakia, 2010; Rodrigues et al., 2015; Sprott et al., 2006). Contact was made with the first authors of each of the included studies to identify additional studies including unpublished studies.

The titles and abstracts were screened by the author and independently double screened by two PhD supervisors. All full text screening was carried out independently by the author and one PhD supervisor. The reviewers initially disagreed on the inclusion/exclusion of four full text papers; these disagreements were resolved through discussion until there was full agreement.

2.3.3 Data extraction

Data were extracted using a standardised, pre-piloted data extraction form. This was based on another data extraction form for behaviour change interventions and was modified to extract key information from the QBE literature.

The following data were extracted from each study included in the review: (1) population characteristics (sample type, study setting, experience, commitment), (2) intervention characteristics (question type, questions based on TPB, correspondence of question and behaviour, degree of correspondence), (3) outcome measures (behaviour type, health behaviour type, normative, behaviour frequency, directedness of behaviour, behavioural ease), (4) methodological factors (behaviour assessment, baseline measure, delivery method, research design, analysis), and (5) risk of bias.

Where studies had multiple experimental conditions compared against a single control, only one of the experimental conditions was chosen for comparison. This was selected as the most similar experimental group compared to control. In the majority of studies there were only minor differences between conditions (e.g., question type used) so the condition with the greatest effect on cognitions or behaviour was then chosen as the comparison. If multiple control groups were used (e.g., no contact control and attitude measure as control) each of these were assessed independently.

2.3.4 Study coding

Studies were corrected for clustering, where required, by adjusting the standard errors of effect sizes based on the recommendations by the Cochrane Handbook (The Cochrane Collaboration, 2008). Sample sizes, where not explicitly stated, were calculated by dividing the total number of participants by the number of condition groups. If further drop out information was included then this was considered as part of the sample size calculation. The lead author extracted the data for all studies. To monitor reliability, 10% of studies were randomly chosen and had data extracted by a co-author; inter-rater reliability was acceptable for all extracted moderators.

The key dependent variable identified by the authors was used in the meta-analysis and input into CMA (Borenstein et al., 2008) and Stata (StataCorp, 2013). In studies using a number of different measures one key measure was chosen based on the most consistently used measure from the majority of studies.

Population: Sample type was separated into (a) university students, (b) adolescent/school pupils, (c) patient populations, and (d) individuals recruited from specific workplaces (e.g. health care workers). Study setting was separated studies into (a) lab, (b) community, (c) medical, (d) educational, and (e) online settings in order to assess if there is an influence of setting over QBE ($\kappa = .78$). Experience with behaviour was coded as (a) Previous experience, and (b) No previous experience, if this was not specifically reported and was not easily inferred based on information in the text, then it was not coded. Commitment level was coded based on level of contact with the experimenter as either (a) high commitment, or (b) low commitment.

Intervention characteristics ($\kappa = 1.0$): Question type was coded as (a) intention alone; (b) intention combined with other cognitions; (c) behaviour prediction; (d) satisfaction, behaviour assessment; and (f) other cognition (neither intention or attitude). Theoretical basis use of Theory of Planned behaviour (a) yes, or (b) no. Correspondence between question and behaviour measures coded into four areas (a) question cognition, DV cognition; (b) question cognition, DV behaviour; (c) question behaviour, DV cognition; and (d) question behaviour, DV behaviour. Correspondence of question also then matched to behaviour in terms of target, context, action and time (TACT); follow up length.

Outcome Measures (all $\kappa = 1.0$): Behaviour was separated into each specific behaviour measured it was then separated into categories of (a) health, (b) consumer, or (c) other.

Health behaviours were then categorised into (a) protection where performing the behaviour is healthy, and (b) risk where not performing the behaviour is healthy. Normative behaviour coded as (a) behaviour encouraged by most others (e.g. eating healthily or behaving healthily); and (b) not when behaviours would generally be discouraged by most others. Behaviour frequency was separated into behaviours that are performed (a) once or close to once (e.g., making a single snack choice), (b) more than once (e.g., regular cancer screening), or (c) unclear frequency. Directedness of behaviour was coded in terms (a) Self-directed: when the behaviour is one that is performed primarily for the interest of the individual performing it (e.g., healthy eating); (b) Other directed: when it is performed for another person; and (c) Both directed, where it is performed for both (e.g., voting). Each of the categories was decided as a group by the study team (including the author and three PhD supervisors) and each study was classified based on the specific sample used and the behaviour that was the key dependent variable, as stated by the study authors. Ease of performing behaviour was categorised as (a) easy (e.g. making a snack choice), (b) moderate difficulty (e.g., blood donation), or (c) difficult (e.g., purchasing a car).

Methodological factors:

Behaviour assessment was separated into (a) subjective, and (b) objectively measured. Studies were also coded for whether had used a baseline behaviour measure or not. Delivery method was coded as (a) face to face, (b) mailed, (c) telephone, (d) PC/Internet, and (e) Other/Unclear. Research design was coded as (a) RCT, (b) Non RCT, and (c) Solomon group design. Return rate was assessed as the percentage reported in the paper. Studies that reported multiple analyses were separated and assessed separately for (a) intention-to-treat results, and (b) per protocol analyses.

Risk of bias ($\kappa = 1.0$): assessed based on the Cochrane Collaboration's Risk of Bias tool and covered sequence allocation, allocation concealment, blinding, incomplete outcome reporting, selective outcome reporting and other bias. Using the recommendations for dealing with bias given by Cochrane, each of the six categories was scored as 0 if it was considered a low risk of bias or 1 if it was unclear or there was a high risk of this type of bias.

Bias was then dealt with in two ways to allow subgroup analysis along with meta-regression analyses: if any one category included a rating of unclear or high risk of bias the overall bias was rated as a 1. Only if all categories of bias were classified as low

then the overall risk of bias was rated as 0. Each category was also totalled to give a total bias score out of 6.

2.3.5 Analysis

Comprehensive meta-analysis software version 2 (Borenstein et al., 2008) was used to calculate effect sizes and for subgroup analyses. Stata (StataCorp, 2013) was used to carry out meta-regression analyses. Hedges g and 95% confidence intervals were calculated for each study based on a random effects model.

In studies where authors reported both intention-to-treat and per protocol analyses (e.g., Godin et al., 2008; Conner et al., 2011; Sandberg & Conner, 2009; & van Dongen et al., 2013), the intention to treat analysis was included in the overall meta-analysis and studies were then reanalysed separately using just per protocol analysis. Publication bias was analysed using funnel plots, Egger's regression test and Trim and Fill analyses. Heterogeneity in effect sizes was assessed by calculating the relevant Q for each study. Univariate meta-regressions were initially conducted to assess the impact of each moderator on the QBE effect sizes. To check for potential confounding, inter-correlations between moderators that significantly predicted QBE effect sizes were assessed. To control for this potential confounding, where moderators were significantly inter-correlated, they were entered in a multivariate meta-regression model.

2.4 Results

2.4.1 Study characteristics

The 65 papers that met the inclusion criteria reported 96 studies/tests of the QBE ($N = 116,087$). The majority of studies reported non RCT designs ($k = 64, 66.7\%$), just under a quarter of studies used a RCT design ($k = 23, 24\%$), with the remaining studies using a Solomon group design ($k = 9, 9.4\%$). The highest proportion of studies also used student samples ($51\%, k = 46$) and assessed the QBE in relation to health behaviours ($51\%, k = 46$). Most studies used questions assessing intent only ($28\%, k = 26$), prediction ($25\%, k = 24$) or behaviour measures ($24\%, k = 23$). The behaviours that were investigated most were purchasing ($21\%, k = 19$), alcohol ($15\%, k = 13$) and voting ($9\%, k = 8$). Table 2.1 provides the full list of included studies and the data that was extracted from each study.

Table 2.1 *Full list of studies included in the review and the key information taken from each study.*

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Ayres et al., 2013	QBE	RCT ^a	0	146 High cholesterol adults	Health plan sign up	Intention, attitudes, AR.	Online	No contact	Obj ^b	Immed ^c	0.03
Bendtsen et al., 2012	Assess reactivity	RCT	1	1639 Undergrads	Alcohol use	Behaviour	Online	No assess	Subj ^d	2 months	0.07
Bernstein et al., 2009	Assess reactivity	RCT	0	102 Pediatric Emergency dept. patients	Marijuana days of use at 12 months	Behaviour	Medic	No assess _e	Subj	12 months	0.26
Bernstein et al., 2010	Assess reactivity	RCT	0	407 14-21 years emergency dept. patients	Alcohol use	Behaviour	Medic ^f	No assess	Subj	12 months	-0.03

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Borle et al., 2007	Non specified	Non RCT	5	5000 automobile customers	Automobile service purchase	Satisfact ^h	Comm	No assess	Obj	12 month	-0.03
Carey & Henson, 2006	Assess reactivity	RCT	1	128 Student heavy drinkers	Alcohol consumption	Drinking frequency	Educat ^g	No assess	Subj	12 month	0.02
Chandon, Morwitz, & Reinartz, 2004	Mere measure	Non RCT	5	391 Grocer customers	Incidence of purchase	Purchase intentions	Comm ⁱ	Not asked intentions	Obj	12 months	0.34
Chapman, 2001	Mere measure	Non RCT	6	436 Undergrad	Health club attendance	Intention	Lab	Unrelated question	Subj	3 days	0.50
Cherpital et al., 2010	Assess reactivity	RCT	0	184 Alcohol dependent emergency room patients	At risk drinking	Behaviour	Medic	No assessm	Subj	12 months	0.10

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Cioffi & Garner, 1998	Non specified	Non RCT	5	373 Undergrads	Blood donation	Prediction	Online	Information only	Obj	Unclear	0.49
Conner et al., 2011 (study 1)	QBE	RCT	0	384 Never screened patients	Health check attendance	TPB	Comm	No question	Obj	Up to 4 months	0.31
Conner, et al., 2011 (study 2)	QBE	RCT	0	1200 Health care workers	Flu vac	TPB	Comm	No question	Obj	2 months	0.12
Cox et al., 2012	Self-prophecy	RCT	2	1175 Attendees of STD clinic	HPV vaccination	Prediction	Medic	No prediction	Obj	4 months	0.06
Daeppen et al., 2002	Assess reactivity	RCT	2	534 ER ^j patients	Mean binge drink occasion	Behaviour	Medic	No assess	Subj	12 months	-0.05
Dholakia & Morwitz, 2002	Non specified	Non RCT	6	2009 customers	New purchase	Satisfact	Comm	No question	Obj	24 months	0.15

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Dholakia, 2010 (study 2)	Non specified	Non RCT	6	83 Commuter students	Service satisfaction	Satisfact	Comm	No question	Subj	Immed	0.74
Dholakia, 2010 (study 3)	Non specified	Non RCT	6	500 Car service customers	Car service purchase	Satisfact	Comm	No question	Subj	4 months	0.3
Dignan, 1996	Non specified	SGD ^j	2	430 Cherokee Indian Women	Smear test attendance	Behaviour intent	Comm	No assessment	Subj	6 months	0.06
Dignan, 1998	Assess reactivity	SGD	1	415 Lumbdee Indian women	Smear test attendance	Behaviour intent	Comm	No assessm	Subj	6 months	-0.13
Falk, 2008 (study 1)	QBE	Non RCT	4	146 Males with driving licence	Risky driving behaviour	Attitude	Comm	No prediction	Subj	4 week	0.41

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Falk, 2008 (study 2)	QBE	Non RCT	4	92 Males with driving licence	Risky driving behaviour	Attitude	Comm	No question	Subj	4 week	0.41
Fitzsimons 2007 (study 1)	Non specified	Non RCT	6	81 Undergrads	Classes skipped	Behaviour prediction	Educat	No prediction	Obj	16 weeks	-0.44
Fitzsimons 2007 (study 3)	Non specified	Non RCT	6	96 Undergrads	Procrastination	Behaviour prediction	Educat	No prediction	Obj	Immed	0.62
Godin et al., 2008	Mere measure	RCT	0	4672 Experienced Blood donors	Blood donation registration	TPB	Comm	No question	Obj	8 months	0.08
Godin et al., 2011	Mere measure	RCT	0	374 Overweight/ Obese	Leisure time PA at 3 month	TPB	Comm	No question	Subj	3 months	0.11
Godin et al., 2013	Mere measure	RCT	0	2000 Lapsed blood donors	Blood donation registrations	TPB	Comm	No question	Obj	12 months	0.2

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Goldstein, et al., unpublished 2008	Mere measure	Non RCT	5	502 Voting age adults	Voting records	Prediction	Online	No prediction	Obj	2 months	0.04
Greenwald et al., 1987 (study 1)	Non specified	Non RCT	6	62 Undergrads	Voting registration	Prediction	Comm	No prediction	Obj	1 day	0.17
Greenwald et al., 1987 (study 2)	Not specified	Non RCT	2	60 Undergrads	Voting	Prediction	Comm	No prediction	Obj	Unclear	0.74
Greenwald et al., 1988, (study 1)	Self-prophecy	Non RCT	0	627 Voting registrants	Voting	Prediction	Comm	No prediction	Obj	Unclear	0.09
Greenwald et al., 1988, study 2	Self-prophecy	Non RCT	2	234 Voting registrants	Voting	Prediction	Comm	No prediction	Obj	Unclear	-0.05

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Janisewski & Chandon, 2007 1a	Mere measure	Non RCT	6	25 Undergrads	Ice cream purchasing likelihood	Intention	Lab	No intent measure	Subj	Immed	0.8
Janisewski & Chandon, 2007 1b	Mere measure	Non RCT	6	63 Undergrads	Ice cream purchasing likelihood	Intention	Lab	No intent measure	Subj	Immed	0.5
Janisewski & Chandon, 2007 study 4	Mere measure	Non RCT	6	127 Undergrads	Candy bar purchase	Intention	Lab	No intent measure	Subj	Immed	0.12
Kvalem et al., 1996	Assess reactivity	SGD	6	281 adolescents	Condom use	Behaviour	Educat	No assessment	Subj	8 months	-0.03
Kypri & McAnally, 2005	Assess reactivity	RCT	6	126 Students	Alcohol consumption	Behaviour	Medic	No assessment	Subj	6 weeks	-0.04
Kypri & McAnally, 2005	Assess reactivity	RCT	6	126 Students	Fruit & Veg	Behaviour	Medic	No assessment	Subj	6 weeks	0.07

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Kypri, et al., 2007	Assess reactivity	RCT	0	252 adolescents	Alcohol use	Behaviour	Medic	No assessment	Subj	8 months	-0.25
Lawrence & Ferguson, 2012 (study 3)	Mere measure	Non RCT	3	292 Undergrads	Drinking	Intent	Educat	No questioning	Subj	2 months	0.35
Levav & Fitzsimons 2006 (study 1)	Mere measure	Non RCT	6	97 MBA students	Flossing	Intent	Unclear	No question	Subj	2 weeks	0.42
Levav & Fitzsimons 2006 (study 1)	Non specified	Non RCT	2	97 MBA students	High fat snack consumption	Intention	Unclear	No question	Subj	Immed	1.33
Levav & Fitzsimons 2006 (study 3)	Non specified	Non RCT	2	37 MBA students	Flossing	Intention	Educat	No question	Subj	1 week	0.83
McCambridge & Day 2008	Assess reactivity	RCT	0	326 Undergrads	Alcohol consumption	Behaviour	Educat	No assessment	Subj	2 months	-0.23

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
McCambridge et al., 2013	Assess reactivity	RCT	0	5263 Undergrads	Alcohol consumption	Behaviour	Online	No assessment	Subj	3 months	-0.05
Milton & Mullan, 2007	Mere measure	Non RCT	0	30 Undergrads	Food safety observation	Intention	Educat	No prediction	Obj	4 weeks	-0.22
Moreira, 2012	Assess reactivity	SGD	0	701 Undergrads	Drinking at 12 months	Behaviour	Comm	No assessment	Subj	9 months	-0.05
Morwitz, 1993	Mere measure	Non RCT	2	8294 Households	Automobile purchase	Intention	Comm	No intent question	Subj	36 months	0.06
Morwitz, 1993	Mere measure	Non RCT	5	8294 Households	PC purchase	Intention	Comm	No intent question	Subj	36 months	0.03
Morwitz & Fitzsimons, 2004 (study 1)	Mere measure	Non RCT	6	167 Undergrads	Candy bar purchase	Intention	Unclear	No intent question	Subj	Immed	-0.16
Morwitz & Fitzsimons, 2004 (study 3)	Mere measure	Non RCT	6	39 Undergrads	Candy bar purchase	Intention	Unclear	No intent question	Subj	Immed	1.05

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Murray, 1988	Hawthorne effect	RCT	6	1161 school adolescents	Smoking	Behaviour plus intention	Educat	No assessment	Subj	5 years	-0.18
Nickerson & Rogers, 2010	Self-prophecy	Non RCT	6	39791 Registered voters	Voting	Prediction	Comm	No question	Obj	Unclear	0.02
Obermiller 2000	Self-prophecy	Non RCT	6	207 University Alumni	Money Donation to University	Prediction	Comm	No prediction	Obj	2 weeks	0.44
Perkins et al., 2008 (study 1)	Self-prophecy	Non RCT	6	76 Undergrads	Recycling attitude	Prediction	Lab	No question	Obj	Immedi ate	0.54
Perkins et al., 2008 (study 2)	Self-prophecy	Non RCT	6	182 Undergrads	Recycling self-identity	Prediction	Lab	No question	Obj	Immedi ate	0.29
Peter & Valkenburg, 2012	QBE	Non RCT	0	118 Dutch household	SEIM adult and adolescent	Intention	Online	No question	Subj	6 months	0.04

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Richmond et al., 1995	Assess reactivity	Non RCT	0	186 Heavy drinking patients	Alcohol consumption	Behaviour	Medic	No assessment	Subj	9 months	-0.04
Sandberg & Conner, 2009	Mere measure	RCT	0	630 Women eligible for Pap smear	Cervical cancer smear attendance	TPB	Comm	No question	Obj	4 months	0.15
Sherman, 1980 (study 1)	Self-generated errors of prediction	Non RCT	3	36 Undergrad women	Writing counter attitudinal essay	Prediction	Comm	No prediction	Obj	2 weeks	-0.75
Sherman, 1980 (study 3)	Same as above	Non RCT	4	92 Undergrad	Charity donation	Prediction	Comm	No prediction	Subj	3 days	1.24
Smith, Gerber, & Orlich, 2003	Self-prophecy	Non RCT	3	588 Registered voters	Voting	Prediction	Comm	No prediction	Obj	Unclear	.002

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Spangenberg & Obermiller, 1996	Self-prophecy	Non RCT	4	81 Undergrads	Cheating	Prediction	Educat	No prediction	Obj	3 days	-0.53
Spangenberg & Greenwald, 1999 (study 1)	Self-prophecy	Non RCT	4	164 Undergrads	Name generation	Prediction	Lab	No prediction	Obj	Immed	0.22
Spangenberg & Greenwald, 1999 (study 2)	Self-prophecy	Non RCT	4	202 Undergrads	Name generation	Prediction	Lab	No prediction	Obj	Immed	0.59
Spangenberg & Sprott, 2006 (study 1)	Self-prophecy	Non RCT	4	123 Undergrads	Health and fitness assess	Prediction	Educat	No prediction	Subj	Immed	0.52
Spangenberg & Sprott, 2006 (study 2)	Self-prophecy	Non RCT	4	86 Undergrads	Charity donation	Prediction	Educat	No prediction	Obj	Immed	0.31
Spence, 2009	Assess reactivity	SGD	0	30 Female undergrads	Physical activity	Behaviour	Educat	No assessment	Subj	1 week	0.46

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Sprott, , 2003 (study 1)	Self-prophecy	Non RCT	4	80 Female undergrads	Low fat snack consumption	Prediction	Educat	No prediction	Obj	Immed	0.44
Sprott, 2003 (study 2)	Self-prophecy	Non RCT	4	137 Undergrads	Health and fitness assess	Prediction	Educat	No prediction	Obj	Immed	0.4
Sprott, Smith, Spangenberg & Freson 2004 (study 1)	Self-prophecy	Non RCT	6	243 Undergrads	Health and fitness assess commitment	Prediction	Lab	No prediction	Subj	Immed	0.43
Sprott, et al., 2004 (study 2)	Self-prophecy	Non RCT	6	121 Undergrads	Health and fitness assess commitment	Prediction	Educat	No prediction	Subj	Immed	0.57
Todd & Mullan, 2011	Mere measure	Non RCT	4	82 Female students	Binge drinking	Intention	Lab	No assessment	Subj	14 days	-0.47
Traeen, 2003	Assess reactivity	SGD	0	109 adolescents	Safe sex behaviour	Behaviour	Educat	No assessment	Subj	9 months	-0.37

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
van Dongen et al., 2013 (study 1)	QBE	RCT	0	7008 New blood donors	Blood donation	TPB	Comm	No question	Obj	6 months	0.03
van Dongen et al., 2013 study 2)	QBE	RCT	0	11789 Active blood donors	Blood donation	TPB	Comm	No question	Obj	6 months	0.04
Van Kerckhove 2012 (study 1)	QBE	Non RCT	6	179 >25 year olds	Brand choice	Intention	Lab	Attitude question	Subj	Immed	-0.42
Van Kerckhove 2012 (study 1)	QBE	Non RCT	6	62 >25 year olds	Memory based brand preference	Intention	Lab	Attitude question	Subj	Immed	0.48
Van Kerckhove 2012 (study 2)	QBE	Non RCT	6	103 Undergrads	Brand preference	Intention	Lab	Attitude question	Subj	Immed	0.82
Van Kerckhove 2012 (study 3)	QBE	Non RCT	6	238 Undergrads	Brand choice	Intention	Lab	No question	Subj	Immed	0.87

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Van Kerckhove 2012 (study 3)	QBE	Non RCT	6	92 Undergrads	Brand preference	Intention	Lab	No question	Subj	Immed	0.37
Van Kerckhove et al., 2012 (study 2a)	QBE	Non RCT	6	87 Undergrads	Brand choice	Intention	Lab	No question	Subj	Immed	-0.16
Van Kerckhove et al., 2012 (study 2b)	QBE	Non RCT	6	106 Undergrads	Brand choice-first choice	Intention	Lab	Attitude question	Subj	Immed	0.75
Van Kerckhove et al., 2012 (study 2b)	QBE	Non RCT	6	106 Undergrads	Brand choice-second choice	Intention	Lab	Attitude question	Subj	Immed	0.42
van sluijs et al., 2006	Assess reactivity	SGD	1	635 Adult recruited from GP	Physical activity	Behaviour	Comm	No assessment	Subj	6 months	0.22
van valkengoed et al., 2002	Assess reactivity	SGD	0	317 Men and women aged 15-40	Chlamydia screening men and women	Behaviour	Medic	No assessment	Obj	Unclear	-0.18

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Walters, Vader, Harris, & Jouriles, 2009	Assess reactivity	Non RCT	3	129 Undergrads	Alcohol use	Behaviour	Educat	No assessment	Subj	12 months	-0.25
Williams, Fitzsimons, & Block 2004 (study 1)	Mere measure	Non RCT	6	202 (no info)	Fatty food consumption	Intention	Educat	No prediction	Obj	1 week	-0.57
Williams, Fitzsimons, & Block, 2004 (study 1)	Mere measure	Non RCT	6	202 (no info)	Tooth flossing	Prediction	Educat	No prediction	Subj	1 week	0.68
Williams, Fitzsimons, & Block, 2004 (study 3)	Mere measure	Non RCT	6	191 (no info)	Healthy snack choice	Prediction	Educat	No prediction	Obj	Immed	-0.6

Name	Study area	Design	Bias risk	Sample	Outcome	Question	Setting	Comparison	Outcome	Follow up	Effect size
Williams, Block, & Fitzsimons, 2006	Non specified	Non RCT	6	167 Undergrads	Exercise	Prediction	Educat	No prediction	Subj	2 months	0.3
Williams, Block, & Fitzsimons, 2006	Non specified	Non RCT	6	167 Undergrads	Illegal drug use	Prediction	Educat	No prediction	Subj	2 months	0.3
Wood et al., 2014	QBE	Non RCT	1	83 Uni staff and students	Healthy snack choice	Prediction	Lab	No question	Obj	Immed	0.35
Young, Adelstein, & Ellis, 2007	Non specified	Non RCT	6	30 Individuals	Motion sickness	Prediction	Lab	No question	Subj	Immed	0.7

Note. ^a RCT is Randomized Control trial. ^b Obj is Objective measure of behaviour. ^c Immed is immediate follow up. ^d Subj is subjective measure of behaviour. ^e Assess is assessment. ^f Medic is medical setting. ^g Educ is educational setting. ^h Satisfact is customer satisfaction. ⁱ Comm is community setting. ^jSGD is Solomon Group Design

2.4.2 Effect size

Overall random effects based on 94 tests showed a small but significant QBE, $g = .14$, $p < .001$, 95% CI [.11, .18]. There was moderate to high heterogeneity among study effect sizes, $I^2 = 72.9%$, $Q = 343.12$, $p < .001$. See Appendix A for the forest plot showing effect size for each study.

Funnel plots showed the effect size was not symmetrically distributed. More studies with a larger effect size had larger standard errors. Egger's regression also revealed significant asymmetry $p < .001$. This suggests that the studies were significantly heterogeneous and at risk of publication bias. A trim and fill analysis (Taylor & Tweedie, 2000) estimated there were 20 missing studies and the inclusion of these studies would produce a small QBE, $g = .08$, 95% CI [.04, .12].

2.4.3 Area tested

Subgroup analyses were carried out to assess the QBE in each of the five areas into which QBE studies have typically been categorised. This found that studies testing self-prophecy had the greatest effect on cognitions/behaviour, $g = .27$, $k = 16$, $p < .01$, 95% CI [.15, .40]; along with studies that did not specify an area, $g = .26$, $k = 18$, $p < .01$, 95% CI [.11, .41]; mere measurement studies, $g = .18$, $k = 18$, $p < .01$, 95% CI [.09, .27]; and studies that specified they were question-behaviour effect studies, $g = .11$, $k = 13$, $p = .001$, 95% CI [.04, .18] had small effects. No significant effect was found in studies from the assessment reactivity literature, $g = .03$, $k = 17$, $p = .14$, 95% CI [-.04, .09].

2.4.4 Sensitivity analysis

Removing studies that used a control group that measures attitudes or otherwise didn't compare against a no measurement control produced a small significant effect on outcomes, $g = .13$, $k = 86$, $p < .001$, 95% CI [.09, .16]. Sensitivity analysis removing Falk (2008) as participants were randomized to condition by day again produced a small effect on outcomes, $g = .14$, $k = 92$, $p < .001$, 95% CI [.10, .17].

A number of studies ($k = 7$) reported analysis separately for participants who had returned questionnaires and therefore been exposed to the QBE manipulation (referred to as per protocol analysis), vs. all participants regardless of whether they had been exposed to the manipulation (intention to treat analysis). When analysing just the data from participants exposed to the QBE questioning (per protocol analysis) the overall

effect size, was larger than the overall effect found for all studies, $g = .48$, $p = .02$, 95% CI [.08, .87]. It was also larger than when looking at the intention to treat analysis of these studies, $g = .07$, $p < .001$, 95% CI [.03, .10].

2.5 Moderators

Subgroup analysis and meta-regression were carried out for each of the 22 moderators; Table 2.2 presents a full list of the subgroup analyses, the full table of regression analyses is reported in Table 2.3.

Table 2.2 *Subgroup analysis of QBE by behaviour*

Moderator	Category	<i>k</i>	<i>g</i>	CI	<i>p</i>	<i>Q</i>	<i>p</i>
<u>Population</u>							
<i>Sample type</i>	Students	46	.27 ^b	.18, .35	.00	22.16	.002
	Medical patients	9	.08 ^a	.01, .15	.02		
	Schoolchildren	6	.12 ^a	-.04, .29	.13		
	Workers	2	.11 ^a	.003, .23	.04		
	Other	31	.09 ^a	.05, .13	.00		
<i>Study setting</i>	Education	18	.16 ^{ab}	.006, .32	.04	25.06	.001
	Medical	10	.06 ^a	-.01, .13	.10		
	Community	26	.07 ^a	.04, .11	.00		
	Laboratory	19	.33 ^b	.19, .47	.00		
	Online	6	.05 ^a	-.01, .11	.10		
<i>Commitment</i>	Low	79	.15 ^a	.11, .19	.00	1.28	.25
	High	15	.08 ^a	-.01, .18	.00		
<u>Intervention</u>							
<i>Question type</i>	Prediction	24	.25 ^b	.13, .37	.00	17.96	.001
	Intention only	26	.23 ^{ab}	.14, .31	.00		
	Combined intention	16	.08 ^a	.02, .13	.004		
	Satisfaction	5	.16 ^{ab}	.002, .32	.04		
	Behaviour	23	.07 ^a	.01, .13	.01		

Moderator	Category	<i>k</i>	<i>g</i>	CI	<i>p</i>	<i>Q</i>	<i>p</i>
<i>Correspondence</i>	Cognition- Behaviour ¹	57	.16 ^b	.11, .20	.01	9.14	.003
<i>of question</i>	Behaviour- Behaviour ¹	26	.07 ^a	.02, .11	.02		
<i>and behaviour</i>							
<u>Outcomes</u>							
<i>Specific</i>	Flossing	3	.61 ^a	.39, .83	.00	83.14	.00
<i>Behaviour</i>	Health assessment	5	.41 ^{ab}	.26, .56	.00		
	Risky driving	2	.37 ^{ab}	.11, .63	.005		
	Drug use	2	.28 ^{bcd}	.04, .52	.02		
	Physical activity	4	.22 ^{bc}	.07, .38	.004		
	Purchasing	14	.18 ^{ce}	.09, .27	.00		
	Vaccination	2	.08 ^{cf}	.009, .17	.03		
	Blood donation	5	.06 ^{df}	.02, .10	.002		
	Screening	4	.01 ^{def}	-.12, .15	.80		
	Condom use	2	-.15 ^{ef}	-.47, .17	.36		
	Voting	8	.06 ^{cf}	-.03, .16	.19		
	Alcohol consumption	12	-.05 ^h	-.11, .007	.09		
<i>Type of health</i>	Risk (unhealthy)	15	-.07 ^a	-.15, .00	.051	5.37	.02
<i>Behaviour</i>	Protection (healthy)	34	.17 ^b	.10, .23	.00		
<i>Normative</i>	Normative	45	.12 ^a	.08, .16	.00	3.26	.20
<i>Behaviour</i>	Unclear	22	.07 ^a	.007, .13	.03		
	Non-normative	12	.08 ^a	.11, .28	.38		

Moderator	Category	<i>k</i>	<i>g</i>	CI	<i>p</i>	<i>Q</i>	<i>p</i>
<i>Directedness of Behaviour</i>	Self-directed	38	.14 ^a	.06, .21	.00	2.07	.36
	Other-directed	20	.07 ^a	.02, .12	.003		
	Both directed	20	.13 ^a	.07, .19	.00		
	Unclear directed	1	.02 ^a	-.09, .03	.40		
<u>Methodology</u>							
<i>Baseline Measure</i>	Not Assessed	81	.16 ^b	.12, .20	.00	14.86	.001
	Assessed	13	.05 ^a	.01, .09	.007		
<i>Delivery Method</i>	Face to face	42	.23 ^a	.14, .33	.00	20.84	.001
	Mail	8	.06 ^b	.03, .09	.00		
	Phone	10	.11 ^{ab}	.03, .20	.00		
	PC / Internet	15	.10 ^{ab}	.03, .17	.00		
	Other/unclear	9	.25 ^{ab}	.01, .49	.04		
<i>Research design</i>	Randomised Controlled Trails	22	.07 ^a	.04, .11	.00	17.29	.001
	Non Randomised Controlled Trials	64	.20 ^b	.15, .25	.00		
	Solomon 4 group	8	.02 ^a	-.13, .17	.77		
<i>Analysis</i>	Per Protocol	7	.42 ^a	.26, .58	.001	15.94	.001
	Intention to treat	7	.08 ^b	.04, .13	.001		
<i>Risk of bias</i>	Low	27	.07 ^a	.04, .10	.001.	14.88	.001
	Unclear/High	67	.20 ^b	.14, .25	.001		

^{ab} Where postscript letters differ, this indicates a significant difference between subgroups.

2.5.1 Population moderation effects

2.5.2 Significant population moderating effects.

Subgroup analyses show significant heterogeneity between studies using different *sample* types, $Q = 22.16, p = .002$. The majority of studies ($k = 46$) used student samples and this sample produced the largest question-behaviour effect, $g = .27, p < .01, 95\% \text{ CI } [.18, .35]$. A much smaller proportion of studies investigated employee and healthcare samples and these two samples were found to produce small effects. Studies focused on specific employee samples, $g = .11, p = .04, 95\% \text{ CI } [.003, .23]$; were similar to the effect on healthcare patients, $g = .08, p = .02, 95\% \text{ CI } [.01, .15]$. A significant negative question-behaviour effect was found in studies using school samples, $g = -.15, p = .13, 95\% \text{ CI } [-.28, -.03]$.

There was significant heterogeneity between studies influenced by *study setting*, $Q = 25.06, p < .001$. A similar number of studies investigated the QBE in community ($k = 25$), education ($k = 25$) and lab settings ($k = 19$). QBE studies based in the lab produced the greatest overall effect on cognitions or behaviour, $g = .33, p < .001, 95\% \text{ CI } [.19, .47]$. This was higher than in an educational setting (e.g., lecture hall), $g = .16, p = .04, 95\% \text{ CI } [.006, .32]$; or a community setting, $g = .07, p < .001, 95\% \text{ CI } [.04, .11]$. A small number of studies were carried out in a health care setting ($k = 7$) or online ($k = 9$). Neither of these settings produced a significant QBE (health care: $g = .06, p = .10, 95\% \text{ CI } [-.01, .13]$; online: $g = .05, p = .10, 95\% \text{ CI } [-.01, .11]$). When entering comparing each type of setting individually against all other settings combined in a meta-regression only lab setting was found to significantly predict the size of effect on the question-behaviour effect, $\beta = .29, p < .01, 95\% \text{ CI } [.14, .44]$.

2.5.3 Non-significant population moderating effects.

Prior experience with the behaviour is a useful moderator to analyse in order to see the sorts of behaviours the QBE can be applied to and whether there are clear restrictions to its application as a behaviour change method. The majority of behaviours tested were those that had been performed previously ($k = 35$) or where prior experience with the behaviour was unclear ($k = 39$). However, there were no effects of *experience* with the behaviour on effect sizes, $Q = .85, p = .66$. There were also no effects of *commitment* on effect size, $Q = 1.28, p = .25$. There was no significant heterogeneity in effect size between studies that included behaviours that had been performed previously compared to those that were novel, $Q = .85, p = .66$.

2.5.4 Question characteristics

2.5.5 Significant question moderators.

Subgroup analysis showed that *question type* was a significant moderator, $Q = 17.96$, $p < .001$. Prediction items ($k = 24$), intentions tested alone ($k = 26$) and behaviour assessment ($k = 23$) were all used most frequently. Smaller proportions of studies assessed intentions combined with other cognitions ($k = 16$) or satisfaction measures ($k = 5$). Prediction items were supported as producing the greatest QBE, $g = .25$, $p < .01$, 95% CI [.13, .37]; along with intention only measures, $g = .23$, $p < .001$, 95% CI [.14, .31]. Smaller effects were found where satisfaction measures were used, $g = .16$, $p = .004$, 95% CI [.002, .32]; intention items were combined with other cognitions, $g = .08$, $p = .004$, 95% CI [.02, .13]; or behaviour alone was assessed, $g = .07$, $p = .01$, 95% CI [.01, .13].

Subgroup analyses were performed on the *correspondence* of question and behaviour, i.e., whether studies measured cognitions or behaviour as the QBE intervention and then whether the follow up outcome measure was a cognition or behaviour measure. Significant heterogeneity was found within this subgroup ($Q = 26.92$, $p < .001$). The largest effect sizes were found in studies assessing behaviour at intervention and cognition at follow up, $g = .36$, $k = 2$, $p = .004$, 95% CI [.12, .61]; and cognitions at both intervention and follow up, $g = .35$, $k = 13$, $p = .01$, 95% CI [.22, .48]. Smaller effects were found in studies using cognition measures at intervention and behaviour at follow up, $g = .16$, $k = 57$, $p = .01$, 95% CI [.11, .20]; although this was significantly stronger QBE than studies measuring behaviour at both intervention and follow up or behaviour at both intervention and follow up, $g = .07$, $k = 26$, $p = .02$, 95% CI [.02, .11]; $Q = 9.14$, $p = .003$. Pairwise comparisons showed a number of significant differences (see Table 2.2).

Studies also varied as to length of *follow up*. Studies varied as to whether they have tested cognitions or behavioural DVs immediately after the questioning has taken place or whether follow up has been longer. This ranged from immediate follow up (e.g., van Kerckhove, Geuens, & Vermeir, 2012) up to five year follow up (Murray, 1988) after they were questioned. A number of blood donation studies have used long term follow up and found increases in behaviour over the course of six and twelve months (Godin et al., 2008) all the way up to fifteen month (Godin et al., 2013). Overall a significant effect of follow up length was found on the size of question-behaviour effect, $\beta = -.001$,

$p = .01$, 95% CI [-.002, -.0003]. This supports a longer follow up length is associated with a smaller effect of the question-behaviour effect.

2.5.6 Non-significant question moderators.

There was no significant effect of *questions based on TPB* ($Q = 3.36$, $p = .07$), although effect sizes were slightly larger in studies not using TPB measures, $g = .16$, $p = .01$, 95% CI [.12, .20]; compared to those using TPB measures, $g = .10$, $p = .01$, 95% CI [.05, .15].

There was no significant difference based on the *degree of correspondence* between question and behaviour ($Q = .47$, Table 2.2). Studies where the question and behaviour were matched on Target, Action, Context and Time produced a slightly higher effect size, $g = .23$, $k = 31$, $p < .001$, 95% CI [.14, .32]; than studies not so matched, $g = .13$, $k = 63$, $p < .001$, 95% CI [.09, .16].

The *number of items* ranged from a single item ($k = 44$) up to 144 items ($k = 1$) and did not significantly predict effect size, $\beta = -.001$, $k = 77$, $p = .16$, 95% CI [-.003, .005].

2.5.7 Outcome characteristics

Subgroup analyses showed significant heterogeneity between studies on different behaviours ($Q = 83.14$, $p < .001$). The QBE was found to have a medium-to-large effect on flossing: $g = .61$, $k = 3$, $p < .001$, 95% CI [0.39, 0.83]; a small-to-medium effect on health assessment: $g = .41$, $k = 5$, $p < .001$, 95% CI [0.26, 0.56]; risky driving: $g = .37$, $k = 5$, $p = .005$, 95% CI [0.11, 0.63]; drug use: $g = .28$, $k = 2$, $p = .018$, 95% CI [0.04, 0.52]; physical activity: $g = .22$, $k = 4$, $p = .004$, 95% CI [0.07, 0.38]; and purchasing: $g = .18$, $k = 14$, $p = .001$, 95% CI [0.09, 0.27].

Small effects were found in vaccination: $g = 0.08$, $k = 2$, $p = .03$, 95% CI [0.009, 0.17]; and blood donation: $g = .06$, $k = 5$, $p = .002$, 95% CI [0.02, 0.10]. Non-significant effects were found for screening: $g = .01$, $k = 4$, $p = .80$, 95% CI [-0.12, 0.15]; condom use: $g = -0.15$, $k = 2$, $p = .36$, 95% CI [-0.47, 0.17]; voting: $g = .06$, $k = 8$, $p = .19$, 95% CI [-0.03, 0.16]; and alcohol consumption: $g = -0.05$, $k = 12$, $p = .09$, 95% CI [-0.11, 0.007]. Table 2.3 shows that a number of these specific behaviours had significantly different QBEs, e.g., flossing had a higher QBE than all other specific behaviours except health assessment and risky driving.

2.5.7.1 Significant outcome moderators.

For type of *health behaviour*, effect sizes were significantly stronger among ‘protection’ compared to ‘risk’ health behaviours ($Q = 5.37, p = .02$). Overall the meta-analysis found that questioning of protection behaviours produced a small significant question-behaviour effect, $g = .17, p < .001, 95\% \text{ CI } [.10, .23]$; where questioning was found to increase these behaviours. Risk behaviours ($k = 16$) which therefore should be risked in order to reduce harmful effects found that questioning produced a much smaller but still significant question-behaviour effect but in this case this meant that these behaviours were slightly reduced by questioning, $g = -.07, p = .051, 95\% \text{ CI } [-.02, -.12]$.

Behaviours were also separated based on *ease of performance*. Subgroup analysis found a significant difference between levels of ease on the question-behaviour effect, $Q = 49.18, p < .001$. Behaviours rated as easy produced the greatest effect on behaviour, $g = .17, p < .001, 95\% \text{ CI } [.10, .25]$; although a significant positive effect was also found in moderately easy behaviours, $g = .08, p < .001, 95\% \text{ CI } [.04, .12]$. Behaviours classified as hard did not produce a significant question-behaviour effect, $g = .01, p = .66, 95\% \text{ CI } [-.06, .09]$.

Subgroup analysis found that effect sizes significantly differed dependent on the directedness of the behaviour, $Q = 71.96, p < .001$. When behaviours were either self-directed (e.g., healthy eating) or were both self and other directed (e.g., voting) this produced a small significant question-behaviour effect (self-directed: $g = .14, k = 38, p < .001, 95\% \text{ CI } [.06, .21]$; self and other directed $g = .13, k = 20, p < .001, 95\% \text{ CI } [.07, .19]$). Other directed behaviours (e.g., blood donation) produced a very small but significant effect, $g = .07, k = 20, p = .003, 95\% \text{ CI } [.02, .12]$.

2.5.8 Non-significant outcome moderators.

No difference in effect size was found for different *behaviour type* when separating outcomes into consumer, health or other domain, $Q = 2.74, p = .25$. The QBE was found to increase consumer behaviour, $g = .18, k = 18, p < .001, 95\% \text{ CI } [.09, .27]$; health behaviours, $g = .12, k = 48, p < .001, 95\% \text{ CI } [.07, .17]$; and behaviours that did not fit into either of these categories, $g = .17, k = 28, p < .001, 95\% \text{ CI } [.10, .24]$. No significant differences were found for whether behaviours were rated as *normative*, $Q = 3.26, p = .20$ or non-normative.

Behaviour frequency was not a significant moderator, $Q = 2.12, p = .35$. Most studies focused on behaviours that were performed more than once, $g = .14, k = 51, p < .001,$

95% CI [.09, .19]. Less common than this were behaviours performed once or close to once, so those that are not regularly performed over any time period ($k = 21$). These behaviours produced a smaller but still significant effect of the question-behaviour effect, $g = .07, p = .001, 95\% \text{ CI} [.03, .11]$. Behaviours that were unclear in their frequency did not produce a significant question-behaviour effect, $g = .08, k = 7, p = .51, 95\% \text{ CI} [-.17, .35]$.

Studies were separated based on *directedness of behaviour* those performed primarily for the benefit of the individual (e.g., healthy eating), the benefit of another person (e.g., blood donation) or the benefit of both self and others (e.g., voting). There were no differences between these $Q = 2.07, p = .36$. The majority of studies focused on self-directed behaviour: $g = .14, k = 38, p < .001, 95\% \text{ CI} [.06, .21]$, followed by both-directed: $g = .13, k = 20, p < .001, 95\% \text{ CI} [.07, .19]$; other-directed: $g = .07, k = 20, p = .03, 95\% \text{ CI} [.02, .12]$; and those that were unclear in behaviour directedness: $g = .02, k = 1, p = .40, 95\% \text{ CI} [-.09, .03]$.

2.6 Methodology

2.6.1 Significant methodology moderators.

The present meta-analysis also assessed specifically whether *measuring behaviour at baseline* influenced the size of effect in studies. The majority of studies did not measure behaviour at baseline ($k = 81$) and small effects were found in these studies, $g = .16, p < .001, 95\% \text{ CI} [.12, .20]$. Even smaller but still significant effects were found in studies that did measure behaviour at baseline, $g = .05, k = 13, p = .007, 95\% \text{ CI} [.01, .09]$; $Q = 14.86, p < .001$.

The *medium of delivery* of questioning had a significant effect on the question-behaviour effect, $Q = 20.84, p = .001$. The majority of studies ($k = 39$) used a face to face delivery method and this produced the greatest QBE, $g = .23, p < .001, 95\% \text{ CI} [.14, .33]$. Smaller effects were found when questions were administered by telephone, $g = .11, k = 13, p < .001, 95\% \text{ CI} [.03, .20]$; PC/Online, $g = .10, k = 15, p < .001, 95\% \text{ CI} [.03, .17]$; and those that were mailed had the smallest effect of the question-behaviour effect $g = .06, k = 8, p < .001, 95\% \text{ CI} [.03, .09]$.

Studies were compared based on the *research design* used. Non-RCTs produced the greatest effect size, $g = .20, k = 64, p < .001, 95\% \text{ CI} [.15, .25]$; followed by studies using a RCT design, $g = .07, k = 22, p < .001, 95\% \text{ CI} [.04, .11]$; with the smallest

effects observed in studies using a Solomon group design $g = .02$, $k = 8$, $p = .77$, 95% CI [-.13, .17]. There was significant heterogeneity between studies based on the study design used, $Q = 17.29$, $p < .001$. Pairwise comparisons showed a significant difference between studies using RCT design compared to non-RCT, $Q = 16.05$, $p < .001$, and non-RCTs compared to studies using a Solomon group design, $Q = 4.81$, $p = .03$, no significant differences were found between studies using RCT and Solomon group design, $Q = .43$, $p = .51$.

The present meta-analyses also compared effect sizes in studies that provided both per protocol analysis and intention-to-treat analysis, $Q = 15.94$, $p < .001$, so in studies where participants are mailed questionnaires comparing the overall sample results (intention-to-treat) against just participants who completed and returned questionnaires (per protocol). Seven studies reported this information and analysed behavioural rates in participants that completed the questionnaire sent to them. This produced a large QBE, $g = .48$, $p = .02$, 95% CI [.08, .87]. Whereas just focusing on intention to treat analysis of the same studies produced a small effect on behaviour, $g = .07$, $p < .001$, 95% CI [.03, .10]. It is likely that participants need to complete and return questionnaires for the QBE to have an impact on behaviour.

2.6.2 Non-significant methodological moderators.

The present review's subgroup analysis also found no effect of whether the *behaviour assessment* measure was subjective or objective, $Q = 1.37$, $p = .71$. Both types of DV measure produced small significant question-behaviour effect effects (subjective: $g = .16$, $p < .001$, 95% CI [.11, .21]; objective $g = .12$, $p < .001$, 95% CI [.06, .17].

A univariate meta-regression also found no effect of return rate on the magnitude of question-behaviour effect, $\beta = -.0003$, $p = .78$, 95% CI [-.002, .001].

2.6.3 Risk of bias

Studies were categorized into two categories, low risk of bias or unclear/high risk of bias. When any of the six categories of risk of bias (sequence generation, allocation concealment, blinding, incomplete outcome reporting data, selective outcome reporting, other sources of bias) was rated as unclear or high risk of bias then the overall study was subsequently categorised as in the unclear/high risk of bias category. The overall study was only rated as low risk of bias if all six risk of bias categories were rated as low risk. The majority of studies were rated as unclear or high risk of bias and among those studies the effect size was small, $g = .22$, $k = 63$, $p < .001$, 95% CI

[.16, .28]. Studies rated as a low risk of bias using a random effect analysis reported a lower overall effect size, $g = .07$, $k = 26$, $p < .001$, 95% CI [.03, .11]. Lower heterogeneity was also found among the low risk studies, $Q = 52.05$, $p < .001$. $I^2 = 51.96\%$, $p < .001$.

Subgroup analysis showed that all six categories of bias individually significantly impacted on effect size. The greatest effects were found in studies biased on sequence allocation, $g = .16$, 95% CI [.08, .02]; incomplete outcome reporting, $g = .14$, 95% CI [.001, .12]; selective outcome reporting, $g = .14$, 95% CI [.07, .22]; and allocation concealment, $g = .12$, 95% CI [.05, .20]. Risk of bias (coded as 0 or 1) was then analysed as a meta-regression and this was found to significantly predict effect size (MM), $\beta = .10$, $p = .006$, 95% CI [.02, .17], suggesting that a higher risk of bias was associated with a greater effect size.

Bias was then calculated as a continuous score from 0-6 for each of the Cochrane risk of bias categories (sequence allocation, allocation concealment, blinding, incomplete outcome reporting, selective outcome, other bias). Studies could score between 0 and 6 dependent on the number of bias categories that were coded as 0 (low risk or bias) or 1 (unclear/high risk). The same pattern was found when entering this continuous score into a meta-regression, $\beta = .02$, $p < .001$, 95% CI [.007, .01], suggesting that studies with a higher risk of bias were associated with larger effect sizes.

Due to the key distinction between protection and health risk behaviour in the present work, risk of bias was re-analysed separately on these two categories of health behaviour: In studies of health risk behaviours with low risk of bias a small, negative and non-significant effect was observed, $g = -.03$, 95% CI [-0.10, 0.04]. In studies of protection health behaviours that were categorised as low risk of bias, a significant positive effect was found, $g = .10$, 95% CI [0.04, 0.16]. In studies categorised as unclear/high risk of bias a small non-significant negative effect was observed in health risk behaviours, $g = -.15$, 95% CI [-0.31, 0.01]; and a significant, positive effect was produced in the protection behaviours, $g = .22$, 95% CI [0.08, 0.36]. This therefore supports non-significant effects of the QBE on health risk behaviours, regardless of the influence of risk of bias. It also supports a significant positive effect on protection behaviours, however the observed effect is larger in studies that were rated as unclear/high risk of bias.

2.6.4 Decline in effect sizes

The number of QBE studies using an RCT design has increased over time ($r = .31, p = .002$) suggesting overall study design and quality has improved over time, however this has not translated into having an impact on overall effect size. No significant effect of year of publication was found on effect size, $g = .006, p = .47, 95\% \text{ CI } [-.002, .01]; I^2 = 73.19\%, R^2 = 1.13\%$.

2.7 Multivariate analysis

All moderators were entered into univariate regressions. See Table 2.3 for the results of these regressions. Correlations were carried out between all significant moderators to investigate potential inter-collinearity between variables; see Table 2.4 for the inter-correlation matrix. Each of the significant moderators from the univariate regression model was then entered into a multivariate model in Stata (Statacorp, 2013).

Table 2.3 *Univariate and multivariate meta-regression analyses.*

Variable		B	k	95% CI	p	Multivariate analyses	
						B (95% CI)	p
<i>Sample type</i>	Student ²	.14	46	.03, .24	.01	.04 (-.07, .15)	.46
	Medical patient ²	-.07	9	-.23, .09	.38		
	School children ²	-.23	6	-.51, .04	.09		
	Workplace ²	.01	2	-.30, .34	.90		
	Other ²	-.06	31	-.16, .04	.23		
<i>Study Setting</i>	Lab ²	.29	18	.14, .44	.001	.31 (.20, .44)	.001
	Medical ²	-.09	10	-.27, .08	.30		
	Community ²	-.07	26	-.18, .03	.16		
	Online ²	-.08	19	-.25, .09	.36		
	Other ²	.15	6	-.01, .33	.08		
<i>Experience</i>	Experience ²	-.04	35	-.15, .06	.39		
	No experience ²	.04	39	-.06, .15	.39		
	Unclear ²	.01	5	-.19, .22	.87		
<i>Commitment</i>	Low ²	.08	79	-.06, .22	.27		
	High ²	-.10	15	-.26, .05	.19		
<u>Intervention</u>							
<i>Question Type</i>	Prediction ²	.09	24	-.04, .22	.18		
	Intention only ²	.06	26	-.06, .18	.32		
	Combined ² intention	-.04	16	-.17, .07	.45		
	Satisfaction ²	-.005	5	-.19, .18	.95		
	Behaviour ²	-.11	23	-.22, .007	.06		
	Other cognition ²	.23	10	-.22, .70	.31		
<i>Questions based on TPB</i>		-.01	10	-.16, .12	.80		

Variable		<i>B</i>	<i>k</i>	95% CI	<i>p</i>	<i>Multivariate analyses</i>	
						<i>B</i> (95% CI)	<i>p</i>
<i>Correspondence of question and behaviour</i>	Question: Cognition ²	.02	57	-.08, .13	.66		
	Question: Behaviour ²	-.13	28	-.24, -.01	.024		
<i>Degree of correspondence</i>	TACT match	-.003	31	-.11, .10	.95		
<i>Number of items</i>		-.001	77	-.003, .0005	.16		
<u>Outcomes</u>							
<i>Behaviour type</i>	Health	-.04	48	-.15, .07	.45		
	Consumer	.009	18	-.12, .14	.89		
	Other	.04	28	-.09, .16	.56		
<i>Dependent variable type</i>	Cognition						
	Behaviour	-.03		-.52, -.10	.004	-.06 (-.29, .18)	.06
<i>Protection/ risk</i>	Health	.003	33	-.13, .14	.96		
	Protection ²						
<i>Normative</i>	Health Risk ²	-.09	16	-.25, .07	.25		
	Normative ²	-.02	45	-.12, .09	.77		
	Unclear ²	.04	22	-.07, .15	.46		
<i>Frequency of Behaviour</i>	Non-normative ²	-.06	12	-.24, .11	.50		
	Once ²	-.09	21	-.20, .01	.10		
	More than once ²	-.01	51	-.12, .09	.77		
<i>Directedness of Behaviour</i>	Unclear ²	.19	7	.05, .33	.01	.002 (-.21, .22)	.89
	Self-directed ²	-.04	38	-.15, .06	.45		
	Other directed ²	-.07	20	-.19, .05	.24		

Variable		<i>B</i>	<i>k</i>	95% CI	<i>p</i>	<i>Multivariate analyses</i>	
						<i>B</i> (95% CI)	<i>p</i>
<i>Research design</i>	RCT	-.09	22	-.19, .02	.12		
	Non RCT ²	.10	64	-.0003, .21	.05		
	Solomon group ²	-.08	8	-.28, .12	.43		
<i>Time interval</i>		-.001	91	-.002, -.0005	.003	-.0002 (-.001, .001)	.80
<i>Return rate</i>		-.0003	21	-.002, .001	.78		
<i>Risk of bias¹</i>		.02	94	.004, .04	.02	.002 (-.02, .03)	.84

Moderators that were significant in the univariate meta-regression model were analysed for correlations, Table 2.4 shows the results of these correlations. Very few of the moderators were highly correlated (>.5). Those moderators that were significantly correlated with other moderators were then entered together into a multivariate analysis to assess which moderators were independent predictors with the inclusion of other moderators. Table 2.3 also shows the results of this analysis using the backward method, where all moderators were entered altogether and individually the least significant moderator was then removed one by one until only significant moderators remained.

Table 2.4 Moderator inter-collinearity matrix for significant moderators in the univariate meta-regression model.

	1	2	3	4	5	6	7	8	9	10
1. Risk of bias										
2. Student population	.29**									
3. Lab setting	-.16	.29**								
4. 'Other' behaviour	.17	.05	.05							
5. Behavioural DV	-.29**	-.14	.079	-.14						
6. Correspondence Question-behaviour (Question: Behaviour Outcome: Behaviour)	-.40**	-.19	.12	-.24**	.19					
7. Unclear directed	.39**	.10	.24**	.21*	-.67**	-.28**				
8. Moderate Ease	-.27**	-.27**	.21*	-.01	.25**	-.07	-.37**			
9. Unclear Frequency	.33*	.08	-.18	.26**	-.55**	-.18	.75**	-.15		
10. Time interval	-.07	-.37**	.20	-.08	.06	.31**	-.13	.17	-.10	

* $p < .05$, ** $p < .01$

The multivariate analysis showed that only lab setting was shown to be a significant moderator after accounting for all other significant moderators. This supports the finding that studies using a lab setting produced a larger QBE than other studies. It also supports inter-collinearity between other moderators, where the other nine moderators that were found to be significant in the univariate analysis do not account for significant variance in effect size when accounting for the effects of the other moderators. The multivariate analysis was also repeated using enter, forward and backward methods to assess the consistency of findings using different methods despite their individual limitations. Using the forward method only lab setting was found to be significant, $\beta = .25$, $p = .007$, 95% CI [.06, .43]. This was also found to be the case using the backward method, where lab setting was the only moderator included in the final model, $\beta = .30$, $p < .001$, 95% CI [.18, .42].

2.8 Discussion

The review presented in this chapter aimed to provide a comprehensive systematic review and meta-analysis of the question-behaviour effect literature in a wider range of studies and with broader inclusion criteria than previous reviews. The results found an overall small, significant effect of questioning of cognitions and behaviour on subsequent behaviour. The results also support a greater impact of the question-behaviour effect in lab studies, student samples, in studies using prediction or intention items, and when questions were delivered face to face. The results also support a smaller effect in studies using a RCT design compared to those using a non RCT design. Related to this, the results supported an influence of risk of bias over a large number of studies and found that studies rated as higher risk of bias produced a greater effect size than studies rated as low risk of bias. The effect found in low risk of bias studies was still significant but very small ($g = .07$, 95% CI [.04, .10]). This suggests that whilst there does appear to be some evidence for a question-behaviour effect, the influence of this on behaviour is very small and potentially susceptible to risk of bias effects. It is likely that the actual influence of questioning is closer to the effect size found in low risk of bias studies, rather than that found in studies that had unclear or high risk of bias influencing their results.

Four reviews and meta-analyses have been carried out very recently in this area. A number of our findings are similar to the results produced in these previous reviews. The review of randomised controlled trials in health behaviours by Rodrigues et al.

(2015) found a similarly small, significant effect of questioning on behaviour and also found significant heterogeneity in studies and an influence of risk of bias. Wood et al. (2016) found a slightly larger effect on behaviour ($d = .24$, 95% CI [.18, .30]) to that found in the present review. Although similarly they also found a greater QBE in lab studies and studies using student samples. A potential explanation for the differing effect size reported in the present review compared to that conducted by Wood et al. (2016) may be due to the treatment of different tests of the QBE within the same study. While the present review selected the condition that was closest to control in studies with multiple conditions, Wood et al. included each test reported within studies individually. It is unclear which effect size would be more accurate, whether Wood's method would produce an overestimation of effect size or our review produce an underestimation. Our inclusion of assessment reactivity studies in the present review was also likely to reduce the overall effect size as these studies overall were shown to have a non-significant effect.

Mankarious and Kothe (2015) suggest that the QBE could be produced purely due to the influence of demand effects. The present review does provide some support for this viewpoint. However, there are a number of well-designed studies that have produced a QBE (e.g., Godin et al., 2008). Their review also suggests that any change in behaviour may be linked with self-selection bias in QBE intervention studies. This may provide at least a partial explanation for the enhanced QBE found in lab studies, where individuals in this setting are typically self-selected to a greater extent than individuals recruited in field studies. However QBE intervention studies typically do not make their aims clear to participants or inform participants that they are being involved in an intervention to change their behaviour. Whilst it is likely that there is some influence of self-selection bias, where individuals are likely to have some interest in the behaviour and this is what motivates them to take part in the research, it is unclear whether this is the main factor at work producing behaviour change.

Key to the aims of the thesis presented here, the present review found a significant difference of the QBE dependent on whether behaviours were protection or health risk behaviours. Based on how behaviours were coded, the QBE was found to produce a small increase in health protection behaviours and a non-significant reduction in health risk or other risky behaviours. Separating studies into those that target protection and risk behaviours also shows a number of key differences in the types of study that have typically focused on the two types of behaviour. More studies have been conducted

focusing on health protection behaviours and the majority of studies in health risk behaviours have been in the assessment reactivity literature investigating measurement effects as a side effect of research. The observed effect size produced in studies of the QBE in protection behaviours with unclear or high risk of bias was greater than that of those rated as low risk of bias (section 2.6.1). In risk behaviours, the QBE produced non-significant effects on subsequent behaviour, regardless of the influence of risk of bias on individual studies. Further studies are required that focus on specifically manipulating the QBE in health risk behaviours.

There are limitations with the review reported in this chapter. By including studies within the various areas of the QBE, while providing a more comprehensive review of the overall literature in this area, this may introduce a greater threat of confounding variables. The review appeared to show evidence of this, where the overall model showed significant heterogeneity. The multivariate meta-regression analyses also demonstrated that while subgroup analyses and univariate meta-regression analyses appear to show a number of significant moderators influence the QBE, these are at significant risk of confounding with one another. Only one moderator was found to independently predict effect size when controlling for all other variables, this was whether studies were conducted in a lab.

The present review focused on studies that used key terms from the QBE literature and therefore there was little overlap in studies included in the present review and that by Mankarious and Kothe (2015). This was due to their review investigating solely the influence of Theory of Planned Behaviour constructs on subsequent behaviour and therefore did not use any of the key terms that are typical within the QBE literature. This suggests a potential issue with the key terms used in the present review, which clearly would need to be even wider in order to include all studies from the QBE literature. However, prospective TPB studies typically do not include a control group and therefore it is unlikely that these studies would have been included within the present review. In addition to this, the review found significant evidence of publication bias within this area, which is likely to be a particular issue due to the small effects produced.

Despite these limitations there are a number of theoretical and practical implications of the review reported in this chapter. The results showed a small, significant effect of the QBE but a high level of risk of bias in a large number of studies. The results also showed studies with higher risk of bias produced a greater QBE than low risk of bias

studies. QBE studies based in the lab appear to produce the greatest effect on cognitions or behaviour. This could be due to the fact that all participants are exposed to the same level of intervention because they are all asked to complete the same QBE questionnaires, or alternatively because these studies typically use student samples and may be advertised to individuals who have an interest in the specific focal behaviour. This will be discussed further in subsequent chapters (e.g., section 6.5.3).

Practical implications of the present review include the clear need for further high quality studies in order to develop a better understanding of the influence of the QBE. The small overall effect of questioning on behaviour, particularly in regards to health behaviours, means that studies require large sample sizes in order to be powered sufficiently to detect an appropriate effect. Further studies are also required generally within the QBE literature with a focus on avoiding risk of bias effects where possible, Chapter 4 of the present thesis aims to help to fill these gaps. In doing this, studies should help to provide a greater understanding of the impact that questioning can have on cognitions or behaviour, this will be the aim of the studies presented in Chapter 3-5. Based on the current state of the literature as outlined in the present review, further research is also required before the QBE can be recommended to be applied as a public health intervention. Future research would benefit from using low risk of bias designs and also include some investigation of the moderators and mechanisms of the QBE to enhance our understanding. This is particularly the case when applying the QBE to health risk behaviours due to the inconsistent findings within studies in this domain. Chapter 4 aim to provide low risk of bias studies using an online delivery and Chapters 3-5 presented here aim to provide an investigation of moderators and mechanisms, including the overarching investigation of setting as a moderator of the QBE.

The evidence from the present review suggests that there are limited studies investigating the impact of the QBE particularly in health risk behaviours and therefore does not provide much of an answer to the debate by Fitzsimons and Moore (2008) mentioned in the Chapter 1 and their suggestion that asking questions relating to performing risk behaviours can produce a negative effect on these behaviours. This is an area that requires further investigation. The work presented in Chapters 3-5 aims to fill this gap in the literature. This is justified, firstly because the evidence for the influence of the QBE on these types of behaviours is not conclusive and secondly because of the potential implications should the application of the QBE prove successful in reducing negative health behaviours. It could be used as a very low

resource intervention to encourage a healthier lifestyle. On the other hand it could also increase these negative health behaviours. This is a potential ethical issue and further research is required to understand what impact the QBE has over these behaviours and the potential moderators and influence of different mechanisms in these types of behaviour.

It is worthwhile investigating the QBE in health risk behaviours as this is an area which the present review demonstrates that there are significant gaps in the literature. As yet it is unclear whether the QBE has potential as a public health intervention in these behaviours, or whether research should focus on trying to reduce the potential unintentional effects of baseline questioning in studies on subsequent behaviour. It would therefore be beneficial to attempt to fill some of these gaps. Since study setting was supported as a key moderator of the effect in the present review, the studies reported in Chapters 3-5 will be reported separated by setting. This aims to demonstrate the influence of the QBE on a range of health risk behaviours and across different settings.

Chapter 3 A schools based investigation of QBE effects on adolescent smoking uptake: A cluster controlled trial.

3.1 Study 1: School based interventions of the question-behaviour effect

As discussed in Chapters 1 and 2, current research into the question-behaviour effect is lacking in relation to health risk behaviours. This is particularly the case in terms of school based interventions based on the QBE. There have previously been only three QBE studies (Kvalem, 1996; Murray, 1988; Træen, 2003) conducted in school settings focusing on health behaviours and only one of these studies targeted a health risk behaviour (Murray, 1988). There are two key benefits to conducting studies within this environment. School based research provides a real-world setting to conduct research. It is also a setting where participants are guaranteed exposure to the intervention, providing they agree to take part. The present chapter will report a study that aimed to investigate the QBE as an intervention to reduce smoking initiation in adolescents.

The review presented in Chapter 2 demonstrated that the QBE produced a small, significant effect in studies that were applied within an educational setting, $g = .16$, 95% CI [.006, .32], however this related to University samples as well as those using school based samples. The overall effect size was small and negative in studies testing both risk and protection behaviours using schoolchildren, $g = -.15$, 95% CI [-.28, -.03]. There were only three studies using this sample type included in the review, two tested safe sex and one tested smoking behaviour. Both studies in schoolchildren focusing on preventative health behaviour (safe sex) found a lower proportion of pupils used condoms in the QBE intervention condition compared to control (Træen, 2003: $g = -.37$, 95% CI -.80, .06; Kvalem, 1996: $g = -.03$, 95% CI -.28, .23). Murray (1988; $g = -.18$, 95% CI -.33, -.03) also found a reduction in smoking behaviour as a result of the QBE intervention.

Murray (1988) investigated the influence of questioning on a subsequent smoking behaviour in adolescent schoolchildren over five years. Participants were repeatedly asked about their self-reported smoking each year over five years from 1974-1978. This experimental group was compared against a sample of 15-16 year olds who had not

been previously questioned on their smoking habits. This study found that significantly more female participants classified themselves as non-smokers in the experimental group ($d = -.18$) however this effect was smaller and not significant for the male participants ($d = .05$; Murray, 1988). Smoking is less prevalent today than it was in the 1970's when the study was conducted by Murray (1988). In 1974, 51% of men and 41% of women smoked, whereas today that number is more like 22% of men and 19% of women (ASH, 2014). It would therefore be beneficial to assess whether the QBE can be applied as an intervention to reduce smoking initiation in adolescent schoolchildren today. This would widen our understanding of the QBE as a potential intervention, and demonstrate whether this low cost intervention could reduce smoking initiation. Previous research also supports the need to test gender differences.

3.1.1 Smoking

Smoking is a behaviour that has serious consequences in terms of an individual's health. Despite this, in the UK there are approximately 10 million adult smokers, with 100,000 smokers dying from smoking related problems and diseases each year. Two thirds of all smokers start before the age of 18 and in 2011 it was estimated that 200,000 children aged 11-15 started smoking (ASH, 2014) and increased smoking is associated with lower socioeconomic status individuals in both adults and adolescence (Hanson & Chen, 2007).

Adolescence is an important time, the proportion of 11 year olds who report that they have tried smoking is 4%, however this increases up to 35% by age 15 (HSCIC, Statistics on Smoking, 2016). In 2012 Yorkshire and Humber regions had the highest prevalence (22.7%) of smoking in the UK (ASH, 2014), although the current rates of smoking in children is the lowest since 1982 (18%; HSCIC, Statistics on Smoking, 2016). One potential method that could be employed to reduce the number of future smoking related health issues is to tackle smoking initiation before smoking has become habitual. Adolescence is a prime time for this sort of intervention due to the high rates of smoking initiation at this time (ASH, 2014).

There are a number of objective measures of smoking available. These include assessing some of the active components of tobacco, such as salivary cotinine, salivary thiocyanate or bi-products produced by cigarette smoking such as carbon monoxide breath levels. Cotinine and carbon monoxide have been found to be most accurate at differentiating smokers from non-smokers (Dolcini, Adler, Lee, & Bauman, 2003).

However, there are issues with using these types of objective measure in inconsistent, non-regular smokers and typically most adolescent smokers fall into this category (Dolcini et al., 2003). The objective measures of smoking are likely to be not entirely accurate and lack sensitivity, in that they are less likely to accurately identify individuals as smokers unless individuals have smoked in the past 24 hours or so. The half-life of carbon monoxide has been suggested to be 2-5 hours, so adolescents who do not smoke daily or otherwise smoke sporadically may not be identified as smokers via carbon monoxide measures (Dolcini, Adler, Lee, & Bauman, 2003).

Despite the potential insensitivity of objective measures of smoking in this sample, one benefit of assessing behaviour objectively as part of a QBE intervention could be that this may increase accuracy of self-reported responding, i.e., a bogus pipeline effect. This measure may produce a conflict between responding accurately (as encouraged by the objective measure) and responding in a socially desirable way (by reporting an intention not to smoke). This conflict may induce cognitive dissonance (section 1.2.2) and motivate a change in behaviour.

Due to the known influence of socioeconomic status (SES) on smoking (e.g., Hanson & Chen, 2007), SES data was inferred at a school level by the percentage of pupils receiving free school meals (FSM). Pupils who receive FSM belong to families receiving benefits/tax credits or are asylum seekers and the receipt of FSM has previously been demonstrated as an indicator of the lowest income families (Hobbs & Vignoles, 2010). This information was taken from annual school census data provided by Leeds City Council and allowed for SES to be accounted for in the study analyses.

3.1.2 Study aims

The present study aims to assess whether repeatedly measuring smoking cognitions (including intentions to “not smoke”) along with subjective and objective measures of smoking status can reduce smoking initiation in year 11 students. Initially a pilot study focusing on year 9 students is reported comparing individuals who had their smoking cognitions and behaviour assessed over three separate occasions against individuals who were assessed for smoking levels on a single occasion. The main study then focused on investigating the influence of smoking cognition and behaviour measurement over five separate occasions (between 2012-2016) and the influence of this on smoking at age 15-16 (tested in 2016) compared to a group with their smoking levels assessed on a single occasion at age 15-16 (tested in 2016).

3.1.3 Hypothesis:

Assessment of smoking cognitions and behaviour will reduce levels of smoking initiation in adolescents in Leeds (age 13-16).

3.2 Method

3.2.1 Participants

A priori sample size calculations were performed using G*Power. Based on the effect size taken from Murray (1988; $g = -.18$ converted to an f value of .09), to produce 80% power and $\alpha < .05$ and based on a one-way ANOVA calculation between the two (experimental vs. control) conditions, the total sample size required would be 972 participants. The clustered nature of the conditions required the calculation of a design effect = $1 + (m - 1) * ICC$ where m is the average sample size for each cluster, the ICC was based on that used by Conner et al., (2013).

- a) The intra-class coefficient was based on that used in the smoking RCT in which the QBE experimental condition data was collected (Conner et al., 2013; $ICC = .01$).
- b) The average cluster size based on the already recruited experimental condition ($N = 200$) and additionally collected data ($N = 50$), therefore the m calculated for this study was $N = 125$ per cluster.
- c) Using the cluster calculation of $1 + (125 - 1) * .01$, a design effect of 2.15 was calculated.

Multiplying the design effect by the original sample size calculated produced an overall sample size of 2089. 1676 participants were recruited into the experimental condition which required 500 participants to be recruited from 10 clusters in the control condition (50 per control cluster).

3.2.1.1 Year 9

Self-reported smoking data was reported by 1676 participants, 1512 of these were in the QBE condition, recruited from eight schools and 164 were in the control condition, recruited from one QBE school and two additional schools. Participants' ages ranged from 13-14 ($M = 13.23$, $SD = .42$). Just over half of participants were male ($N = 878$, 52.4%) and 798 (47.6%) were female. The percentage of pupils receiving Free School Meals (FSM) in the recruited schools ranged from 6.7-46.0%.

3.2.1.2 Year 11

Self-reported smoking data was reported by 1489 participants, 1307 of these were in the QBE condition, recruited from eight schools and 102 were in the control condition, recruited from two further schools. Participants' ages ranged from 15-17 ($M = 15.23$, $SD = .51$). Just over half of participants were male ($N = 785$, 52.1%) and 722 (47.9%) were female. The percentage of pupils receiving FSM in the recruited schools ranged from 6.7-24.7%.

3.2.2 Measures

3.2.2.1 Experimental questionnaire

A total of 24 items assessed smoking related cognitions. The questionnaire included three intention items related to "not smoking" anchored on a five point scale ("I plan not to smoke; I don't want to smoke; I will try not to smoke" strongly disagree-strongly agree). Participants were also questioned on seven attitude items ("For me, smoking would be" bad-good; harmful-beneficial; unpleasant-pleasant; unenjoyable-enjoyable; foolish-wise; not fun-fun; healthy-unhealthy). Participants were also tested on other items linked to smoking including: family member smoking behaviour and use of e-cigarettes along with a number of other items not reported here (see Appendix B1).

3.2.2.2 Smoking measure: Objective measure

A measure of expired carbon monoxide was used to assess smoking levels during the previous 48 hours (Bedfont, 2015). This reports carbon monoxide parts per million levels and percentage carboxyhaemoglobin.

3.2.2.3 Smoking measure: Self-reported measure

Participants were also questioned on their current smoking status using two items ("I have never smoked; I have only ever tried smoking once; I used to smoke sometimes, but I never smoke cigarettes now; I sometimes smoke cigarettes now, but I don't smoke as many as one a week; I usually smoke between one and six cigarettes a week; I usually smoke more than six cigarettes a week"; "ONLY answer this question if you have **never smoked** or **only tried it once**: I have never had one puff of a cigarette; I did once have a puff of a cigarette; I have tried smoking a few times, but I never smoke now; I do sometimes smoke cigarettes, but not as many as one a week").

3.2.2.4 Control questionnaire:

Control condition participants were provided with a questionnaire assessing intentions and subjective smoking, these questions were the same as described in section 3.2.2.3 and were provided to one group of participants recruited at year 9 and a separate group recruited at year 11. A small sample of participants were also requested to provide an objective measure of carbon monoxide levels as a measure of objective smoking.

3.2.3 Design

The data for the experimental condition exposed to the QBE was collected as part of a large scale randomised controlled trial (see Conner et al., 2013 for study protocol) assessing the impact of a separate intervention on smoking initiation. This intervention involved all participants being tested on their smoking related cognitions, including intentions to not smoke and other cognitions taken from the Theory of Planned Behaviour (Ajzen, 1991) over five years. Participants were asked for their levels of smoking, measured both through subjective measures of whether the individual smokes and how much. It was also measured objectively using a Smokerlyzer machine designed to measure the levels of carbon monoxide in the lungs. This acted as a measure of whether the individual has been exposed to cigarette smoke in the past 48 hours. The control condition were recruited at follow up and therefore participants were not randomised to condition. Year 9 control participants were recruited from schools already taking part in the Conner et al. (2013) RCT, participants were recruited from a different year group from those in the experimental QBE condition (QBE condition tested 2014, control recruited 2016). This was in order to reduce school related differences in the two conditions where possible. Year 11 control participants were recruited from schools not recruited to the RCT at baseline and data were collected in the same year as the experimental QBE condition (2016). Allocation of condition was clustered in that individual schools were recruited into either the experimental QBE or control condition. This study was approved by the University of Leeds, School of Psychology Ethics Committee (ref: 15-0235).

3.2.3.1 Year 9 data collection

Figure 3.1 shows a diagram explaining when measures and outcome data were collected for pupils in year 9 and year 11. QBE smoking data was collected from eight schools from the Leeds Education Authority when pupils started secondary school in September 2012 (year 7; age 11-12 years) until 2014 (year 9; age 13-14 years).

Comparison group data was collected for year 9 students who had not previously had

their cognitions or behaviour tested in January 2016. At this point the experimental group had previously been assessed on smoking cognitions and behaviour on three separate occasions.

3.2.3.2 Year 11 data collection

Year 11 students had their experimental data collected on four occasions (year 7-11; collected between 2012 and 2016). Control group data were collected from new schools not previously involved in the study. All pupils in the control group schools were tested for their smoking related cognitions and self-reported smoking levels, a small number of control participants were also assessed on their objective levels of smoking, however this was not possible in all control participants.

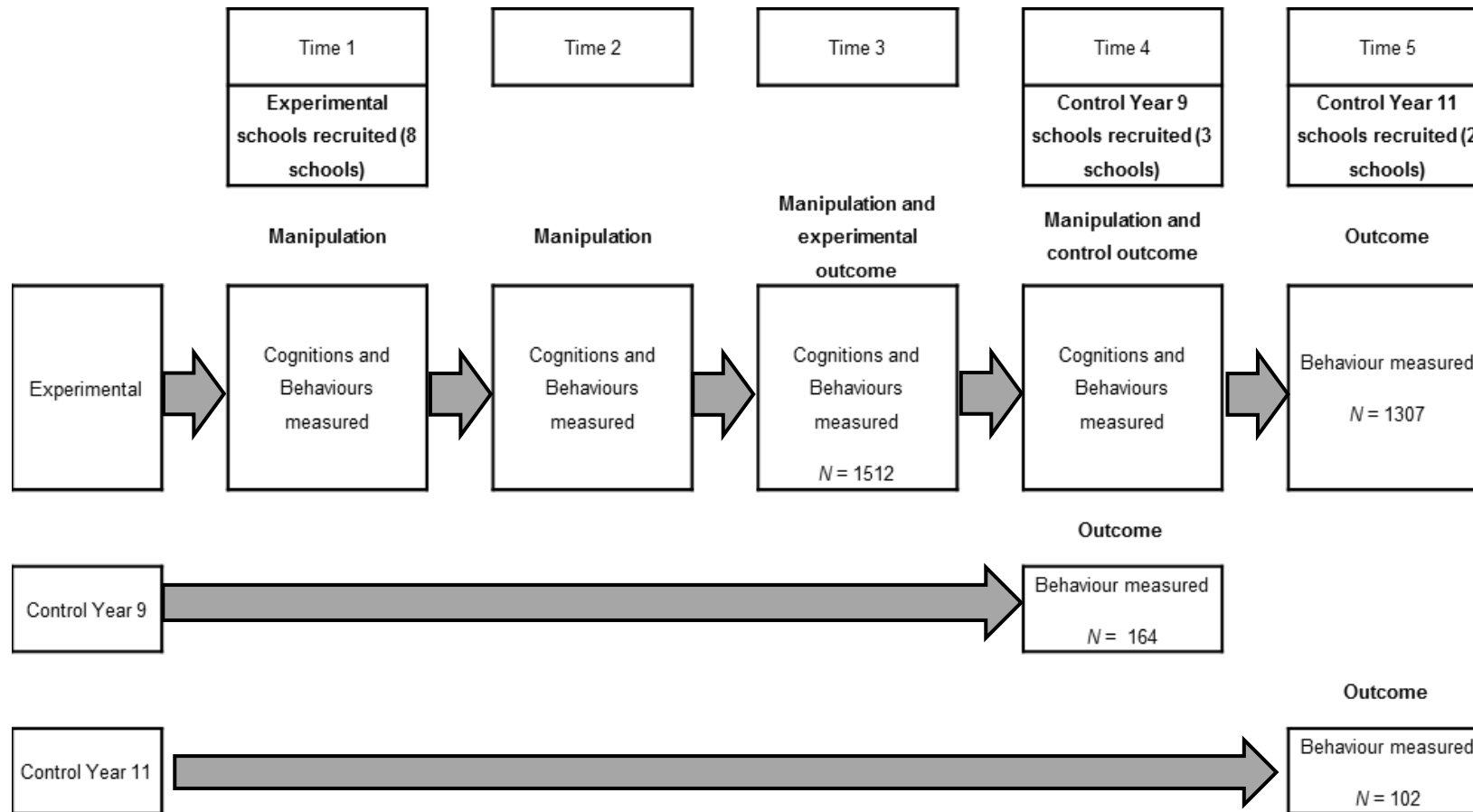


Figure 3.1 Measures taken for year 9 and year 11 data.

3.2.4 Procedure

3.2.4.1 Year 9 data collection

All schools from both intervention ($N = 12$) and control ($N = 8$) schools recruited for the Conner et al. (2013) RCT were invited to take part in the present study in order to provide comparison data. Key individuals were contacted and invited to take part. Participants were recruited from pupils in the year below the QBE focal group with the aim of reducing variability in the data by collecting comparison data from the same schools as provided the QBE experimental data. Three schools agreed to take part, only one school was recruited from a QBE school. The two other schools were from the intervention arm of the Conner et al. (2013) RCT and were therefore different schools to those recruited into the QBE experimental condition.

3.2.4.2 Year 11 data collection

Schools were recruited from Leeds Education Authority. Schools in the QBE condition were the same as the QBE schools reported in section 3.2.4.1. These schools were recruited in 2012 and pupils were assessed on their smoking behaviour and cognitions on an annual basis until December 2016. Control participants were recruited from schools not previously recruited into the Conner et al. (2013) smoking trial. Eighteen schools were invited to participate in the study and two schools agreed to take part. In the QBE condition, all pupils in year 11 of the recruited schools were assessed on their levels of self-reported smoking along with an objective measure based on a Smokerlyzer machine reading. Participants from the control schools were selected by the school contact and self-reported smoking data was collected from these schools on a single occasion in autumn 2016.

3.2.4.3 Planned analyses

Success of randomisation was examined using ANOVA and Chi-square. The effect of condition on the measures of behaviour was analysed. A hierarchical regression was conducted with Condition entered in Step 1, Gender and Age entered in Step 2 and School and % FSM entered in Step 3. This was conducted with the objective measure of smoking for the year 9 data, although this was not available for year 11 data. The same analysis was then repeated using the smoking statements as the outcome variable.

A dichotomous dummy variable was then created to indicate whether participants smoked at present and a binomial regression was performed with the dichotomous measure of smoking as the DV.

3.3 Results

3.3.1 Year 9 data

Conditions significantly differed on mean age. Participants in the control condition ($M = 13.40$, $SD = .49$) were significantly older than participants in the experimental condition ($M = 13.21$, $SD = .41$), $F(1, 1674) = 31.10$, $p < .001$. There was no difference between conditions for the proportion of boys and girls included in each, $\chi^2(1, N = 1676) = .03$, $p = .86$. In the experimental condition 52% ($n = 791$) of participants were male, this value was 53% ($n = 87$) in the control condition. On average participants were most likely to report that they had never smoked in both experimental (74.9%) and control conditions (74.5%), there was no difference between conditions for self-reported smoking, $F(1, 1663) = 1.82$, $p = .18$. The majority of participants also reported never having had a single puff of a cigarette in both experimental (77.1%) and control (79.4%) conditions, the difference between conditions was not significant, $\chi^2(3, N = 1549) = 5.75$, $p = .12$.

In terms of the objective measure of smoking, a score of more than 5 CO ppm would indicate smoking. Scores ranged in the experimental condition from 0 ($n = 16$) to 7 ($n = 1$) and from 0 ($n = 2$) and 4 ($n = 3$) in the control condition. The average was low for both experimental ($M = 1.67$, $SD = .76$) and control conditions ($M = 1.65$, $SD = .70$). A total of just 12 participants scored above the threshold for smoking, all these participants were in the experimental condition. A hierarchical regression was conducted with the objective measure of smoking as the outcome variable and the predictors entered as follows Step 1: Condition; Step 2: Gender, Age; Step 3: School, % Free school meals. Two of the predictors were significant: gender, $\beta = -.09$, $SE = .04$, $p = .02$ and school, $\beta = -.02$, $SE = .008$, $p = .01$. Condition, $\beta = -.15$, $SE = .08$, $p = .08$; Age, $\beta = .03$, $SE = .04$, $p = .56$ and FSM did not significantly predict objective smoking, $\beta = -.001$, $SE = .002$, $p = .58$.

This was repeated on the smoking statements data. In this analysis only FSM was found to be a significant predictor, $\beta = .09$, $SE = .003$, $p < .01$. Condition, $\beta = -.13$, $SE = .09$, $p = .13$; Age, $\beta = .03$, $SE = .04$, $p = .56$; Gender, $\beta = .03$, $SE = .04$, $p = .50$; Age, $\beta = .02$,

$SE = .05$, $p = .62$, and school did not significantly predict the self-reported smoking statement, $\beta = -.008$, $SE = .008$, $p = .32$.

Finally, a binomial regression was performed, with participants who reported that they had never smoked, tried once or used to smoke classified as ‘non-smokers’, and participants who reported that they sometimes smoked or smoked between 1-6 or >6 cigarettes per week classified as ‘smokers’. This dichotomous measure of smoking was entered as the DV. The predictors entered as follows Step 1: Condition; Step 2: Gender, Age; Step 3: School, % Free school meals. Only gender was supported to significantly predict smoking, $\beta = .70$, $SE = .21$, $p < .01$ with more girls reporting that they currently smoked ($N = 68$, 8.6%) compared to boys ($N = 39$, 4.5%). Age, condition, school and FSM were not found to significantly predict smoking (Condition: $\beta = .57$, $SE = .57$, $p = .31$; School: $\beta = .05$, $SE = .04$, $p = .30$; Age $\beta = .07$, $SE = .24$, $p = .77$). Table 3.2 shows the Beta values for each predictor and smoking statements and dichotomous smoking as outcome variables.

3.3.2 Year 11 data

One way ANOVA and Chi² analyses were conducted to assess whether conditions differed on age, gender or % free school meals (FSM). Conditions did not significantly differ on mean age, $F(1, 1502) = .09$, $p = .77$ or gender $\chi^2(2, N = 1508) = .22$, $p = .90$. Conditions did differ significantly on the socioeconomic status of schools based on the percentage of pupils receiving free school meals, the QBE condition had a greater percentage of pupils receiving FSM ($M = 14.51$, $SD = 6.16$) compared to control ($M = 10.25$, $SD = .25$).

Table 3.1 shows the descriptive statistics for each of the smoking statements for the experimental and control conditions. A greater proportion of the pupils in the control condition reported that they had never smoked ($N = 74$, 72.5%) compared to the QBE condition ($N = 847$, 61.1%). This pattern was in the opposite direction for the data reporting the number of puffs of a cigarette participants reported. Participants in the QBE condition were more likely to report that they had never had a single puff of a cigarette ($N = 842$, 70.5%) compared to control ($N = 68$, 66.7%), $\chi^2(4, N = 1297) = 156.42$, $p < .01$.

Table 3.1 *Descriptive statistics and frequency of smoking for QBE and control conditions in Year 11.*

	QBE Experimental	QBE Control
	<u>M (SD/N)</u>	<u>M (SD/N)</u>
Age	15.23 (.51)	15.24 (.43)
Dichotomous smoking¹		
Non smoker	85% (1179)	89% (91)
Current smoker	15% (208)	10.8% (11)
Smoking Statements		
I have never smoked	61.1% (847)	72.5% (74)
I have only ever tried smoking once	16.1% (224)	14.7% (15)
I used to smoke sometimes, but I never smoke cigarettes now	7.8% (108)	2% (2)
I sometimes smoke, but I don't smoke as many as one a week	6.4% (89)	6% (5.9)
I usually smoke between one and six cigarettes a week	3.3% (46)	2% (2)
I usually smoke more than six cigarettes a week	5.3% (73)	1% (1)
Missing	0% (0)	2% (2)
Total	100% (1387)	100% (101)
Have you taken a puff of a cigarette?		
I have never had one puff of a cigarette	70.5% (842)	66.7% (68)

	QBE Experimental	QBE Control
	<u><i>M (SD/N)</i></u>	<u><i>M (SD/N)</i></u>
I did once have a puff of a cigarette	11.9% (142)	10.8% (11)
I have tried smoking a few times, but I never smoke now	11.9% (142)	7.8% (8)
I do sometimes smoke cigarettes, but not as many as once a week	5.8% (69)	2% (2)
Missing	0% (0)	12.7% (13)

¹Dichotomous smoking categorised all individuals who reported that they never smoked, tried smoking once or used to smoke as ‘non smokers’. Individuals who reported that they sometimes smoke, or currently smoke 1-6 or >6 cigarettes a week as ‘smokers’.

A hierarchical regression performed on the smoking statements data with predictors entered as follows Step 1: Condition; Step 2: Gender, Age; Step 3: School, % Free school meals. In this analysis Condition was found to be a significant predictor, $\beta = 19.57$, $SE = 4.33$, $p < .01$, supporting overall greater smoking reported in the control condition when controlling for the other variables. Gender, $\beta = .31$, $SE = 1.89$, $p = .87$; Age, $\beta = 1.16$, $SE = 1.86$, $p = .53$; School, $\beta = -.07$, $SE = .42$, $p = .87$ and % FSM did not significantly self-reported smoking statement, $\beta = .02$, $SE = .16$, $p = .92$.

The same binomial regression performed on the year 9 data was repeated on the year 11 data, with participants classified as ‘smokers’ or ‘non-smokers’. The majority of participants in both QBE ($N = 1179$, 85%) and Control ($N = 91$, 89%) conditions, reported not smoking. In the QBE condition 208 participants (15%) reported smoking and 10.8% of participants in the control condition reported smoking ($N = 11$), $\chi^2(1, N = 1489) = 1.34$, $p = .25$. Only gender was supported to significantly predict smoking, $\beta = .30$, $SE = .15$, $p = .04$ with more girls reporting smoking ($N = 118$, 16.5%) compared to boys ($N = 101$, 13%). Condition, Age, School and % FSM were not found to significantly predict smoking (Condition: $\beta = .59$, $SE = .37$, $p = .11$; School: $\beta = .06$, $SE = .03$, $p = .07$; Age: $\beta = .17$, $SE = .16$, $p = .28$; % FSM: $\beta = .02$, $SE = .01$, $p = .17$).

Table 3.2. *Regression analyses for smoking statements and dichotomous smoking in year 9 and year 11 students.*

Variable	Smoking statements ¹			Dichotomous smoking ²		
	<i>B</i>	<i>SE</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>p</i>
Condition						
<i>Year 9</i>	-.13	.09	.13	.57	.57	.31
<i>Year 11</i>	19.57	4.33	.001	.59	.37	.11
Gender						
<i>Year 9</i>	.03	.04	.50	.70	.21	.01
<i>Year 11</i>	.31	1.89	.87	.30	.15	.05
Age						
<i>Year 9</i>	.02	.05	.62	.07	.24	.77
<i>Year 11</i>	-1.16	1.86	.53	.17	.16	.28
School						
<i>Year 9</i>	-.008	.008	.32	.05	.04	.30
<i>Year 11</i>	-.07	.42	.87	.06	.03	.07
% FSM						
<i>Year 9</i>	.009	.003	.001	.006	.02	.67
<i>Year 11</i>	.02	.16	.92	.02	.01	.17

¹ Smoking statement based on hierarchical regression, β values reported are unstandardized with *SE*. ² Dichotomous smoking based on logistic (binomial) regression.

3.4 Discussion

The present study aimed to investigate the influence of assessing smoking related cognitions and behaviour on an annual basis over five years on smoking behaviour at three and five year follow up, compared against a control group only assessed on a single occasion. The results of the present study demonstrated mixed results, where in the year 11 data a smaller proportion of participants in the QBE condition reported never having smoked, compared to control. However when controlling for age, gender, SES and school the pattern in data supported greater smoking reported in the control condition with condition supported as a significant predictor of smoking statements. When smoking behaviour was dichotomised based on whether participants had never smoked/tried smoking/used to smoke vs. those who currently smoked, condition was no longer a significant predictor and the pattern in the data then supported greater current smoking in the QBE condition compared to control. However, the size of comparison group used in the present study reduced the potential power to detect a difference between conditions and therefore limits the conclusions that can be drawn from this.

The present study also tested differences between conditions of individuals tested on their smoking cognitions and behaviour on three separate occasions at age 13-14, compared against a control condition tested on a single occasion. The results of this demonstrated that too few of the participants reported smoking behaviour to detect a difference between conditions. This corresponds with previous research which has suggested that smoking initiation is key at age 15-16, where regular smoking increases from 1% at age 11 up to 8% at age 15 (HSCIC, Statistics on Smoking, 2016). In the year 11 data presented here, 38% of the participants across both conditions reported ever having smoked, this is slightly higher than previous estimations (35%; HSCIC, 2016).

One previous study investigated the influence of assessing self-reported smoking on subsequent smoking behaviour in an adolescent sample. Murray (1988) conducted their study in the 1970's and found a significant reduction in cigarette smoking in individuals assessed on smoking compared to control. Rates of smoking over the past five years have dropped and recent behaviour has changed with a greater percentage of secondary school pupils who have tried e-cigarettes at least once (22%) compared to traditional cigarettes (18%; HSCIC Statistics on Smoking 2016). The present study demonstrated that between 27.5-38.9% of pupils in the Control and QBE conditions

respectively reported that they had smoked at least on one occasion. The present study also demonstrated that gender was the only significant predictor of smoking, where females were more likely to report smoking compared to males. This is in-line with previous evidence supporting a higher proportion of female adolescent smokers (e.g., Murray, 1988; Health Survey for England, 2015).

The percentage of pupils receiving free school meals (FSM) in each of the participating schools was used as an indicator of socioeconomic status (SES). Pupils receiving FSM have previously been demonstrated to be more likely to belong to the lowest income families (Hobbs & Vignoles, 2010). Despite previous research suggesting adolescent smoking is associated with lower SES, although as a less stable indicator of health risk behaviours in adolescent samples compared to adults (Hanson & Chen, 2007), the present study did not find consistent support for SES as a significant predictor of smoking in the year 11 data. The school pupils attended was also entered into the regression as the pupils were clustered within schools and the measure of SES was based on school level data. The school attended was only found to be a significant predictor of the objective measure of smoking in the year 9 data, FSM was not found to be a significant predictor of smoking. One potential explanation for this could be due to other factors beyond SES that influence the objective measure of smoking, such as environmental factors that can influence the readings provided using carbon monoxide based assessments of smoking.

The present study aimed to investigate the influence of assessing cognitions and behaviour on multiple occasions on smoking initiation in adolescents aged 13 and 15-16. A strength of the study included the longitudinal assessment of both cognitions and behaviour in a school setting on a number of occasions over five years. The present study also used an objective measure of smoking behaviour in the QBE condition, however due to the irregular and non-habitual nature of smoking in this sample along with the lack of objective data from the comparison condition, the objective measure data is of limited use. Also as discussed further later in this discussion, the sample size recruited was a limitation of the present study. Due to the nature of the study design (using previously collected data as part of a different intervention) the present study was unable to randomise participants to condition.

The limitations of the study mean that limited conclusions that can be drawn regarding the influence of the QBE on adolescent smoking initiation. First, while in the experimental QBE condition all participants completed the smokerlyzer measure, this

was not possible in the control condition, therefore participants in the experimental condition may have been more honest with their responding due to the potential for the researcher to validate their self-reported responses to the objective measure. Previous studies have included items that test time since last cigarette and inhalation patterns to give a more accurate idea of smoking.

Second, the present study had issues with low recruitment of control schools to provide comparison data against the QBE condition. Schools and participants in the control condition were not recruited at baseline and recruiting schools at follow up was difficult, where out of eighteen schools contacted for recruitment only two agreed to take part. In addition to this, due to the nature of the QBE condition and its involvement as the control group in a large scale RCT, all participants in the QBE condition were tested on their smoking cognitions and behaviour. However the control schools selected the classes for recruitment. There is therefore some likelihood of self-selection bias in the comparison group data, which may have included pupils with lower levels of smoking. Also, the collection of year 9 data aimed to assess the influence of the QBE where cognitions and smoking had been assessed on a single occasion, however the number of participants who reported smoking in either condition was very low. This demonstrates the need for smoking related research to focus on older adolescents who have a greater likelihood of having tried smoking in order to assess any influence of interventions on smoking initiation in this sample.

Due to these limitations, the theoretical implications on our understanding of the QBE are limited based on the present study. The study aimed to investigate the influence of assessing smoking related cognitions and behaviour on multiple occasions in a school setting over smoking initiation of adolescents based in Leeds schools in year 11 (age 15-16). The majority of pupils reported not smoking, with 38% of pupils reporting that they had tried smoking on at least one occasion. A slightly higher percentage of individuals in the control condition reported not smoking at present compared to the QBE condition. This may be due to the increased attention associated with questioning, which may have activated scripts relating to smoking in the QBE condition (e.g., Sherman, 1980). No overall influence of condition was found on smoking and socioeconomic status as assessed by free school meals status did not predict smoking. Only one variable significantly predicted smoking, where female pupils were more likely to report smoking compared to male pupils.

In terms of practical implications, the present study demonstrates some of the potential issues with conducting field based research of the QBE, particularly where data collection and recruitment is attempted separately for experimental and comparison QBE conditions. Comparison data sources should be established at baseline where possible. However the present study demonstrates the difficulty with motivating schools to take part in research where they are not being actively given an intervention. Further studies would benefit from developing recruitment strategies that involve equivalent participant numbers in QBE and control conditions, such as asking participants to complete alternative questionnaires at baseline. Studies would also benefit from randomising participants to condition and recruiting participants to detect an effect of the QBE. The meta-analysis in chapter 2 demonstrated that study setting is influential over the QBE and further studies are required to better understand QBE influences over risk behaviours in different study settings.

Chapter 4 **Three online studies of the QBE in various health risk and health promotion behaviours.**

4.1 Introduction

One of the key findings from the literature review presented in Chapter 2 was the influence of risk of bias along with the generally small effect sizes produced in studies of the QBE. Large sample sizes are therefore required for studies to be powered sufficiently and much of the work previously conducted has been underpowered. The results of study 1 demonstrate some of the difficulties in recruiting participants into QBE studies and in particular into comparison conditions tested only at follow up. Conducting studies online allows for greater sample sizes to be collected, which should increase the power of studies, along with providing a setting with potentially low risk of bias. The present chapter reports three studies conducted online which together aim to investigate the QBE's influence over a range of health risk behaviours (and in study 4, protection health behaviours). All three studies also investigate the potential influence of dissonance over the QBE in this setting.

Despite the potential benefits of performing QBE studies online, to date there have been only a small number of QBE studies to use online methods. Only nine online studies were included in the meta-analysis from Chapter 2 which included studies on both protection and health risk behaviours, the evidence from these studies supported null effects of the QBE when questions are delivered online, $g = .05$, 95% CI [-.01, .11]. One potential explanation for these non-significant effects may be the type of question used. Two out of the three online studies measured behaviour alone at baseline as the QBE intervention; the evidence from Chapter 2 suggests that whilst questioning intentions and predictions of future behaviour appear to increase health behaviours and therefore may have the greatest potential to influence health risk behaviours, questioning behaviour alone was not supported to have such an influence on behaviour. The evidence is therefore limited due to the small number of studies that have investigated the QBE in this way where five studies focused on alcohol use; these studies had a great deal of heterogeneity in effect sizes, ranging from small negative effects, ($g = -.05$, $SE = .08$, Moreira et al., 2012) to moderate positive effects ($g = .47$, $SE = .12$, Kypri & McAnally, 2007).

An alternative explanation for the lack of QBE found on health risk behaviours in online studies could be due to specific limitations when applying the QBE within this setting. More specifically, questioning online may not activate the same mechanisms as using other methods of questioning. In terms of the processing fluency explanation of the QBE as described in section 1.2.3 and by Dholakia (2010), online questioning has the potential to disrupt processing fluency since there are likely to be a greater number of distractions available when individuals answer questionnaires online rather in a lab setting. This may reduce the depth of processing involved when individuals are completing the questionnaires which in turn may reduce any potential influence of the QBE.

As outlined in Chapter 1, dissonance is suggested to be a key mechanism underlying the QBE. There are some suggestions that individuals respond differently when using online questionnaires, where individuals answer in a less socially desirable way compared to pen and paper questionnaires (Davidov & Depner, 2011). Online surveys are suggested to produce a more impersonal situation, where individuals are able to feel more anonymity and answer more honestly (Booth-Kewley, Larson, & Miyoshi, 2007). If the QBE occurs, as Sherman (1980) suggests, when individuals overestimate their behaviour in a socially desirable direction, using online methods may reduce the general over-prediction and therefore make a QBE less likely to occur. Online questioning may therefore produce a reduced level of cognitive dissonance compared to other delivery methods.

4.1.1 Study aims

Three studies (studies 2-4) are presented in this chapter, with the overall aim to investigate the influence of the QBE on a range of health-risk behaviours using online questionnaires. A variety of different health-risk behaviours are investigated in order to assess QBE influences over a range of different behaviours across follow up lengths from shorter term (one week) to longer term (one month). In addition to this, dissonance was investigated in each of the studies to get a better understanding of its influence on the QBE in an online setting, dissonance was measured in studies 2 and 3 and manipulated in study 4.

The individual aims of each of the three studies reported in the present chapter are as follows. Study 2 aimed to investigate the QBE by assessing the impact of questioning predictions relating to a specific unhealthy snacking behaviour (biscuit consumption).

This was assessed over one week follow-up. Study 3 aimed to look at QBE influences in smoking. However the form of smoking selected differs from that presented in Chapter 3, as does the specific sample. Instead of smoking initiation, the target behaviour is social smoking, defined as smoking a majority of times with other people or as often with others as when alone (Moran, Wechsler, & Rigotti, 2004). This behaviour is suggested to be common within young people aged 18-24, although there generally has been limited research into its prevalence, one sample of college student smokers found 51% were social smokers (Moran et al., 2004). Finally, Study 4 aimed to investigate the QBE in a range of different health-promotion and health-risk behaviours. It aimed to assess the influence of indirectly manipulating the level of dissonance experienced by participants, through exposing individuals to instructions that emphasised the importance of health and living a healthy lifestyle. The study compares six health behaviours (3 health promotion and 3 health risk) from baseline to follow up, after exposure to a QBE intervention.

4.2 Study 2: Investigating QBE influences on specific unhealthy snacks

Study 2 aimed to assess the impact of manipulating the framing of prediction questions focusing on a specific unhealthy snacking behaviour (biscuit consumption) on subsequent self-reported biscuit consumption. It compared whether asking participants prediction questions relating to ‘doing’ a health risk behaviour would increase performance of behaviour compared to being asked about ‘not doing’ or ‘avoiding’ the behaviour. Only one previous published study to date has manipulated the framing of QBE questions. Levav and Fitzsimons (2006) suggested it to be easier to mentally represent questions relating to ‘avoid’ behaviour than using a negation (‘not doing’) and, as a result, completing measures relating to ‘avoiding’ behaviour may be more effective in reducing that behaviour than completing measures relating to ‘not doing’ the behaviour. Study 2 focused on biscuit consumption as the specific health risk behaviour. Unhealthy snack foods such as biscuits tend to be energy dense (Piernas & Popkin, 2010) and are likely to contribute towards excess energy intake. Biscuit consumption was selected as the specific behaviour as these along with cakes constitute a key source of sugar consumption for the UK public (National Diet and Nutrition Survey, 2014).

There has been only one previous published study in the QBE literature to manipulate whether the focal behaviour included as the intervention questions was specific or general. This study found that only questions focusing on a specific behaviour produced a positive effect on behaviour, whereas both general questioning and control questioning had no impact on behaviour (Spratt, 2006). This supports the attitude accessibility explanation for the QBE, where specific questioning activates attitudes toward the specific behaviour. However, in the recent meta-analysis by Spangenberg, Kareklas, Devezer, and Spratt (2016) they suggest that asking about general behaviour is more likely to activate a dissonant reaction than asking about specific behaviour, which will therefore be more likely to produce a change in behaviour. In order to test this, the present study focused on a specific health risk behaviour, it also assessed dissonance as an additional measured variable. It would be expected that participants in the experimental conditions would report a higher level of dissonance compared to the control conditions. Based on previous work on question framing in QBE studies (Levav & Fitzsimons, 2006) and specific questioning of behaviour (Spratt et al., 2004), the following hypothesis were generated.

4.2.1.1 Hypotheses

- 1) Significantly more biscuits will be consumed in the experimental conditions compared to control.
- 2) The experimental conditions will significantly differ from one another in terms of the number of biscuits consumed where:
 - 2a) Participants asked to predict likelihood of avoiding biscuits (avoid condition) will consume significantly fewer biscuits compared to the doing and not doing conditions.
 - 2b) Participants asked about their likelihood of consuming biscuits (doing condition) will consume the highest number of biscuits, followed by the condition asked about likelihood of not eating biscuits (negation condition).
- 3) More generally, significantly more unhealthy snacks will be consumed in the experimental conditions compared to the control condition.
- 4) The experimental conditions will significantly differ from one another in terms of the proportion of unhealthy snacks consumed where:

4a) Participants asked to predict likelihood of avoiding biscuits (avoid condition) will consume significantly fewer unhealthy snacks compared to the doing and not doing conditions.

4b) Participants asked about their likelihood of consuming biscuits (doing condition) will consume the highest proportion of unhealthy snacks, followed by the condition asked about likelihood of not eating biscuits (negation condition).

5) Experimental and control conditions will significantly differ on the levels of dissonance reported at follow up.

4.2.2 Method

4.2.2.1 Participants

A priori sample size calculations using G*Power based on the average of previous studies investigating question wording and the average effect of online studies ($f = .14$), using 80% power and alpha of $<.05$ and a one-way ANOVA with four conditions. 564 participants were required (141 participants per condition) to detect a difference between experimental and control conditions (one-tailed). Nine hundred and thirty five participants were recruited to complete the initial questionnaire, 568 completed the follow up (61% return rate). Participants ages ranged from 18-73 years ($M = 26.73$, $SD = 9.87$). Of the 874 participants who reported their age and gender 258 were males (29.5%) and 614 were female (70.4%), 515 (58.8%) were students and 356 (40.7%) were non-students.

The study was advertised to staff and students of Leeds University, it was also advertised online via social media and on Prolific Academic (a crowdsourcing platform that advertises studies to individuals interested in participating in academic research studies online). Participants were offered a chance to win a prize draw for taking part. Prolific Academic was used to recruit 247 participants, these participants were offered £2.30 for completing both parts of the study.

4.2.2.2 Design

The study was an experimental independent groups design study with four conditions; it had three experimental conditions and one control condition. The independent variable was the wording of the prediction questionnaire that participants received. The three experimental conditions manipulated question wording relating to biscuit

consumption in the next week (doing, avoid, negation) and those in the control condition were asked to predict their likelihood of using the internet in the next week. The primary outcome was the number of biscuits consumed over the week following completion of the questionnaire. The secondary outcome was the proportion of healthy snacks reported to be consumed in the week. Also assessed as an additional variable was the degree of dissonance participants experienced when thinking about their biscuit consumption at follow up. This study was approved by the University of Leeds, School of Psychology Ethics Committee (ref: 15-0079).

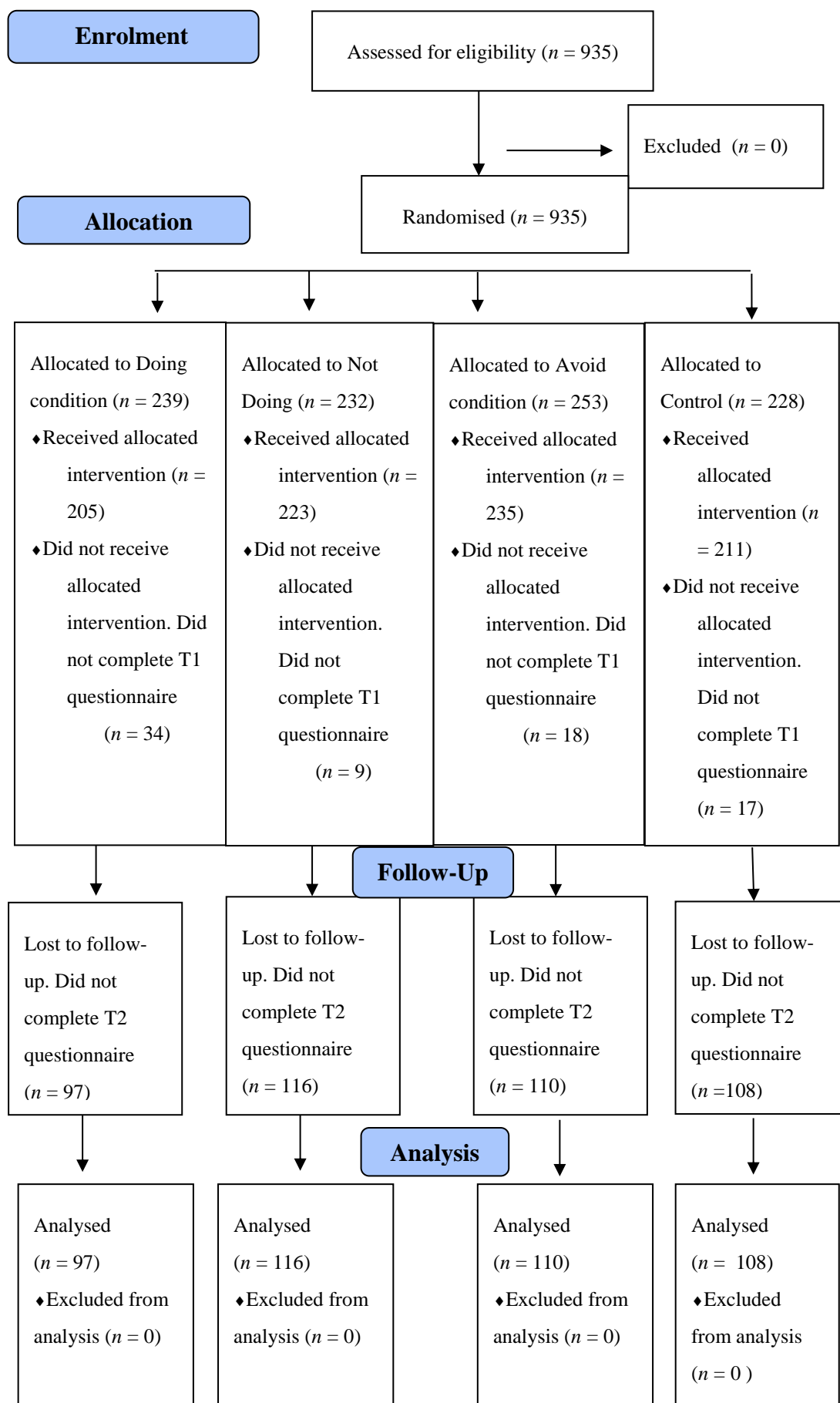


Figure 4.1. CONSORT flow diagram for study 2.

4.2.2.3 Materials

4.2.2.3.1 Prediction questionnaires

Doing questionnaire. Seven items were used to assess participants' likelihood and attitudes toward eating biscuits in the next week. Three prediction items were anchored on a 5 point scale ("Do you predict you will eat biscuits in the next week?"; "Will you eat biscuits in the next week?" Definitely no-Definitely yes. "How likely are you to eat biscuits in the next week" Highly likely-Not at all likely; $\alpha = .96$). Four attitude items were used anchored on a five point Likert scale ("Would eating biscuits in the next week be...?" Not enjoyable-Enjoyable; Bad-Good; Harmful-Beneficial; Not worthwhile- Worthwhile; $\alpha = .74$).

Avoid questionnaire. The avoid questionnaire was identical to the 'doing' questionnaire, with one key difference - the same seven items related instead to 'avoiding eating biscuits' in the next week ("Do you predict that you will avoid eating biscuits in the next week?"; "Will you avoid eating biscuits in the next week," Definitely no-Definitely yes. "How likely are you to avoid eating biscuits in the next week?" Not at all likely-Highly likely; $\alpha = .93$). Four attitude items were used anchored on a five point Likert scale. ("Would avoiding eating biscuits in the next week be...?" Not enjoyable-Enjoyable; Bad-Good; Harmful-Beneficial; Not worthwhile-Worthwhile; $\alpha = .72$).

Not doing condition. This was identical to the other two experimental conditions, with one key difference- the same 7 items related to 'not eating biscuits' ("Do you predict that you will not eat biscuits in the next week?"; "Will you not eat biscuits in the next week". "How likely are you to not eat biscuits in the next week?"; $\alpha = .76$). Four attitude items were used anchored on a five point Likert scale. ("Would not eating biscuits in the next week be...?" Not enjoyable-Enjoyable; Bad-Good; Harmful-Beneficial; Not worthwhile-Worthwhile; $\alpha = .67$).

Control condition. The control questionnaire was identical to the experimental questionnaires but, this time, the items related to using the internet in the next week. ("Do you predict that you will use the internet in the next week?"; "How likely are you to use the internet in the next week?" "Will you use the internet in the next week?"). Four attitude items were used anchored on a five point Likert scale. ("Would using the internet in the next week be...?" Not enjoyable-Enjoyable; Bad-Good; Harmful-Beneficial; Not worthwhile-Worthwhile).

4.2.2.3.2 Dependent variables.

Snack diary. Participants were emailed a 7 day retrospective snack diary, identical to the one used in a QBE study investigating healthy snacking by Wood et al. (2014), although it had not been previously validated. This was completed one week after answering the prediction questionnaire. The snack diary had spaces for each of the past 7 days and prompted participants to state the number and exact snacks that were eaten at three time points during each day, these were: before lunch, after lunch and after dinner. Each snack was coded as healthy or unhealthy by the experimenter, with snacks low in fat/sugar (e.g., fruit, yoghurt) coded as healthy and high fat/sugar snacks coded as unhealthy (e.g., chocolate, cake, crisps). The total healthy and unhealthy snacks were added up by the experimenter. The secondary dependent variable was the proportion of unhealthy snacks (total healthy snacks/total healthy and unhealthy snacks) consumed over the 7 day period. Participants were asked to report the number of biscuits consumed over each day of the past week.

Dissonance. Participants were also asked to report their levels of psychological discomfort (i.e., dissonance) when thinking about their biscuit consumption. This was questioned at follow up using five items (“Thinking about my biscuit consumption makes me feel uncomfortable”; “Thinking about my biscuit consumption makes me feel uneasy”; “Thinking about my biscuit consumption makes me feel anxious”; “I worry about my biscuit consumption”; “The difference between how many biscuits I think I should consume and how many I do makes me uncomfortable”) rated on a seven point scale (Strongly disagree-Strongly agree; $\alpha = .95$). This measure had not previously been validated due to a lack of available pre-validated measures of dissonance.

4.2.2.4 Procedure

Participants were directed to the online link of the survey where they were randomised to condition and asked to read information about the study and indicate their consent to take part. They were then directed to the seven question items relating to their predictions about the next week; the exact wording of the question differed dependent on condition. Three of the questions asked participants to predict their likelihood of performing specified behaviour, the other four questions asked participants to report their attitude toward performing the behaviour.

Participants were emailed after one week with a second online questionnaire. This asked them to state the snacks they had eaten at specific time points (before lunch, after lunch, after dinner) over the past week since completing the first questionnaire.

Participants were then asked to report the total number of biscuits they had consumed over each day of the previous week since completing the first questionnaire. Finally, they were also asked to report their levels of dissonance when thinking about their biscuit consumption. They were then fully debriefed as to the aims of the experiment and given contact details of who to contact if they had further questions.

4.2.2.5 Planned analyses

Success of randomisation was examined using ANOVA and Chi-square. The effect of condition on the measures of behaviour was analysed. The effects of the manipulation on behaviour was assessed using separate hierarchical ANOVAs with one factor (Condition: experimental vs. control) and 3 nested levels for the experimental group. This aimed to detect differences between the experimental and control conditions, along with potential nested effects of the three experimental conditions. Finally the effect of condition on dissonance was analysed and a regression analysis was conducted with condition (dummy coded as experimental vs. control) and dissonance entered as predictors and biscuit consumption as the outcome variable.

4.2.3 Results

4.2.3.1 Randomisation

No differences by condition was found on age, $F(3, 870) = .16, p = .92$; gender, $\chi^2(6, N = 874) = 7.66, p = .27$, or occupation $\chi^2(6, N = 872) = 5.56, p = .47$, suggesting that randomisation to condition was successful. The two key dependent variables (total biscuit consumption and proportion of healthy snacks consumed) were assessed for levels of skew. This analysis found both dependent variables were significantly negatively skewed (proportion of healthy snacks $Z = 4.49$, total biscuits $Z = 18.34$). Parametric tests were conducted initially on all dependent variables. Non-parametric tests were subsequently conducted only where parametric tests suggested there was a significant difference between conditions.

4.2.3.2 Condition x snack consumption

4.2.3.2.1 Biscuit consumption

Table 4.1 shows the means and standard deviations for each of the key dependent variables separated by condition. Self-reported biscuit consumption over the course of the week ranged from 0-21 biscuits. Participant biscuit consumption per week was low ($M = 5.38, SD = 7.15$). A hierarchical ANOVA with one factor (condition: control vs. experimental) and 3 nested levels for the experimental group found there were no significant differences between the experimental conditions compared against the control group for the total number of biscuits consumed, $F(1, 439) = .46, p = .50$. No significant differences were found when comparing the three experimental conditions against each other, $F(2, 439) = .45, p = .64$. There was little difference between each of the four conditions, the greatest number of biscuits were consumed by the Doing condition ($M = 6.08, SD = 8.34$), followed by Not Doing ($M = 5.53, SD = 6.99$), Avoid ($M = 5.20, SD = 7.00$), and Control conditions ($M = 5.07, SD = 6.68$). The data were re-analysed after excluding participants who had not eaten any biscuits over the past week and when excluding outliers, the non-significant patterns in the data remained the same for both of these analyses. The pattern in data was also the same when using a median split on the data.

4.2.3.2.2 Proportion healthy snacks consumed

The proportion of healthy snacks consumed over the week follow up was calculated based on the difference between the total healthy snacks divided by the total number of healthy and unhealthy snacks consumed. A hierarchical ANOVA with one factor (condition: control vs. experimental) and 3 nested levels for the experimental group found there were no significant differences between the experimental conditions compared against the control group for the proportion of healthy snacks consumed, $F(1, 423) = .104, p = .75$. No significant differences were found when comparing the three experimental conditions against each other, $F(2, 423) = .13, p = .88$. There was little difference between each of the four conditions, the highest proportion were consumed by the Not Doing condition ($M = .34, SD = .26$), followed by Avoid ($M = .33, SD = .25$), Doing ($M = .33, SD = .24$) and Control conditions ($M = .33, SD = .24$).

Table 4.1 Means (SD) for key dependent variables in snack and biscuit consumption in each condition.

	Condition Means (SD)			
	Not Doing	Avoid	Doing	Control
Biscuit total	5.53 (6.99)	5.20 (7.00)	6.08 (8.34)	5.09 (6.68)
Proportion Healthy	.34 (.26)	.33 (.25)	.33 (.24)	.33 (.24)
Total Snacks	14.6 (9.5)	14.71 (7.1)	13.76 (8.75)	13.17 (7.7)
Mean snacks	2.09 (1.36)	2.10 (1.03)	1.97 (1.25)	1.88 (1.10)
Total healthy snacks	5.17 (4.5)	5.15 (4.89)	4.94 (4.88)	4.43 (4.52)
Questionnaire response (1-5)	2.83 (1.17)	2.77 (1.35)	3.43 (1.29)	
Dissonance	2.30 (1.48)	2.20 (1.52)	2.31 (1.43)	2.27 (1.69)

4.2.3.3 Dissonance

The average dissonance rating was low ($M = 2.29$, $SD = 1.51$), where higher scores out of 7 reflected a greater level of reported dissonance. There was no difference found between experimental and control conditions for reported dissonance, $F(1, 439) = .003$, $p = .96$, and no difference between levels of dissonance in the different experimental conditions, $F(2, 439) = .05$, $p = .95$. The Doing condition reported the greatest dissonance ($M = 2.31$, $SD = 1.43$), Not doing ($M = 2.30$, $SD = 1.48$), Control ($M = 2.27$, $SD = 1.69$), Avoid ($M = 2.20$, $SD = 1.52$).

When condition (QBE vs. control) and dissonance were both entered into a regression, condition was not found to be a significant predictor of biscuit consumption ($\beta = .03$, $p = .54$), dissonance was a significant predictor of biscuit consumption ($\beta = .34$, $p < .001$) suggesting that higher levels of reported dissonance were associated with greater biscuit consumption, once the interaction between condition and dissonance was entered in a second step of the regression dissonance remained a significant predictor, $\beta = .40$, $p < .01$, the interaction between these was not significant $\beta = -.07$, $p = .40$. A mean intention (prediction) score was calculated and this was then entered along with

dissonance into the regression, dissonance was still found as a significant predictor ($\beta = .30, p < .01$), however intention was not ($\beta = -.06, p = .27$). Neither condition ($\beta = .009, p = .86$) nor dissonance ($\beta = -.13, p = .16$) were significant predictors of the proportion of healthy snacks consumed.

4.2.4 Discussion

The present study found no effect of asking individuals to predict future levels of a specific unhealthy snacking behaviour on subsequent biscuit consumption or general snacking. It also found no influence of these prediction questions on levels of self-reported dissonance. As such none of the study hypotheses were supported. There was no difference between the conditions on self-reported biscuit consumption.

The study findings also did not support the previous findings by Levav and Fitzsimons (2006) which suggested that the specific framing of the question influences the impact of questioning on behaviour. While this previous study found no difference between asking individuals about 'doing' and 'not doing' in regards to consuming fatty snacks, they found that asking about 'avoiding' reduced likelihood of choosing a fatty snack in a food choice task produced a greater reduction in behaviour than the other two forms of questioning. This difference between conditions due to framing of questions was not supported in the present study. One key difference between the present study and that conducted by Levav and Fitzsimons (2006) is the study setting, where their study was not conducted online and as supported by the meta-analysis reported in Chapter 2, QBE studies in online settings have typically produced very small effects.

The prediction score supported greater biscuit consumption in individuals who reported that they were likely to consume biscuits over the next week, or who reported that they had low likelihood of avoiding consuming biscuits. This analysis suggested higher biscuit consumption and a smaller proportion of healthy snacks were consumed in those who had higher predictions (doing condition) or reported lower likelihood of avoiding eating biscuits (avoid condition), supporting participants acting in-line with their reported predictions however the present study also demonstrated that making these predictions did not then influence the levels of subsequent behaviour. This analysis was conducted by entering prediction scores from each condition separately and then again when the data were exposed to a median split. Although there are issues with separating prediction ratings into low/high for each condition, this was conducted

to gain a better idea of the pattern in consumption in high vs. low predictors of biscuit consumption without separating predictions into each of the separate conditions.

There are a number of potential explanations for the lack of QBE found. Generally, predictions were low and on average were close to the midpoint on the scale for the Not Doing and Avoid conditions, although predictions were significantly higher in the Doing condition. In addition to this, general biscuit consumption was low; it is likely that participants had low motivation to change their behaviour. This is also supported by the low dissonance ratings reported by participants when thinking about their biscuit consumption. This suggests that participants had low levels of psychological discomfort when thinking about their behaviour and therefore they were not motivated to change.

Dissonance ratings were found to significantly predict biscuit consumption. However this was in the opposite direction to that expected, where high levels of dissonance relating to consuming biscuits were associated with a greater likelihood of consuming biscuits in the next week. The measure of dissonance was completed at follow up after participants had reported their levels of behaviour, rather than during the initial questionnaire completion in order to reduce potential contamination effects. This suggests that individuals with greater consumption were more likely to feel greater levels of worry or anxiety (psychological discomfort) when thinking about their consumptions levels, however this discomfort did not then motivate them to change their behaviour. The dissonance levels reported may have been lower when participants were first asked the prediction questions rather than immediately after they were asked to self-report their behaviour, therefore drawing attention to the exact levels of behaviour. Future studies may benefit from assessing dissonance immediately after questioning or assessing it on multiple occasions to assess whether this changes over time. In order to explore the influence of dissonance over individuals who perform high vs. low levels of behaviour, future studies may benefit from assessing behaviour at baseline to allow baseline behaviour to be controlled for in subsequent analyses. Also, the measure of dissonance used in the present study has not been previously validated due to a lack of pre-validated questionnaires tapping this construct. It is therefore difficult to ascertain whether the measure was truly measuring dissonance, future studies would benefit from developing a validated measure of dissonance to use in similar studies.

The present study aimed to investigate the QBE using an online setting, it also aimed to investigate the impact of manipulating question framing and the influence of this over a specific health risk behaviour. Due to participant drop-out, the study was not sufficiently powered to detect a difference between conditions and no significant effects were found. One potential explanation for this is due to the generally low levels of the specific focal behaviour performed by participants, along with potentially low motivation toward changing this. As previously stated, using an online setting has been suggested to foster a sense of anonymity and reduce social desirability of responses, which may therefore reduce the overall levels of dissonance experienced when completing the QBE questionnaire. Future studies would benefit from focusing on either more general behaviours or those where individuals are likely to have conflicting cognitions towards, and are therefore more likely to be motivated to change in response to exposure to a QBE intervention.

4.3 Study 3: Investigating QBE influences in social smoking and social drinking

One explanation for the lack of effect found in study 2 is that participants had low motivation to change the focal behaviour, particularly as motivation has previously been demonstrated to be important to the QBE (e.g., Ayres et al., 2013). This was supported by the low levels of behaviour reported along with low levels of dissonance associated with behaviour performance. Study 3 was conducted to focus on two behaviours (social smoking and social drinking) that are supported to have greater prevalence in the target sample (young adults). They are also behaviours with well-known associations with negative health outcomes and therefore individuals are likely to have greater motivation to change compared to the focal behaviour from study 2.

Young adults aged 16-34 are suggested to have the highest smoking rate of any age group (Statistics on Smoking, 2015). Rather than being a habitual behaviour, it is more common for adults of this age group to be intermittent or social smokers, defined as having smoked in the past 30 days but mainly or exclusively with others (Song & Ling, 2011). In 2001, a cross sectional survey of 10,904 college students found 51% of the 2401 current smokers were social smokers and social smoking was found to be inversely associated with nicotine dependence (Moran, Wechsler, & Rigotti, 2004). Additionally 35.7% of 18-25 year olds are suggested to report having smoked in the

past 30 days in the USA (US Department of Health and Human Services, 2008). Social smoking may be more open to change due to the lack of nicotine dependence compared to regular, habitual smoking (Moran, Wechsler, & Rigotti, 2004).

There is a lack of consensus as to what is meant by 'light smoking;' some authors have suggested it to be levels of 1-4 cigarettes per day (Schane, Glantz, & Ling, 2009) whereas other authors have suggested < 10 cigarettes per day (Bjartveit & Tverdal, 2005). Even low levels of smoking are associated with a number of health risks including cardiovascular problems and cancer (Bjartveit & Tverdal, 2005). Social smoking is a behaviour that is suggested to start out as experimental but that can progress into an addiction (DiFranza et al., 2000). Previous research suggests that 50% of social smokers will continue to smoke either intermittently or habitually over a number of years (Song & Ling, 2011).

There are also mixed findings about the characteristics of social smokers. Song and Ling (2011) found smoking mainly or only with others was positively associated with intentions to quit within the next 6 months and with quitting smoking for a month or longer. However, another study found social smoking to be inversely associated with intention to quit smoking and with having made a recent quit attempt (Horan, Wechsler, & Rigotti, 2004). Light and intermittent smokers have also been associated with risky drinking and smoking for positive rather than negative reinforcement (Coggins et al., 2009), along with mainly smoking in public settings that are associated with drinking alcohol, such as parties, bars, and nightclubs (Schane, Glantz, & Ling, 2009). Craving has been supported to predict these types of smoking, however situational factors such as being at home made it less likely for the light and intermittent smokers to smoke (Thrul, Buhler, & Ferguson, 2014). Social smoking is suggested to occur in response to the normative behaviours of others in a group setting, where the group identity outweighs any dissonance that individuals would otherwise experience (Hoek, Maubach, Stevenson, Cadall, & Edwards, 2013). Exposure to a QBE intervention might bring this individual dissonance into sharp focus and therefore reduce the behaviour.

In addition to social smoking, the present study will also investigate the influence of the QBE on drinking, due to the relationship between these two behaviours, whereby social smoking is suggested to be performed in conjunction with heavy alcohol use (Harrison, Desai, & McKee, 2008). Drinking in itself is associated with a wide range of health consequences, it is causally linked to cancer, injury and cardiovascular disease along

with having an association with performance of other risky behaviours (WHO, 2014). Despite this, the current prevalence for drinking at a hazardous level is 15-20% in women and men respectively and is suggested to cost the NHS £3.3 billion annually (Scarborough et al., 2011). The majority of work reported in Chapter 2 investigating the QBE in alcohol use ($k = 12$) focused on individuals assessed using the AUDIT which is a scale used to assess hazardous drinking levels and found mixed effects of the QBE in these studies (e.g., Bendtsen et al., 2012; Bernstein et al., 2010; Daepfen et al., 2007), where studies were often conducted in a hospital setting. The present study used mainly young adult participants recruited from University settings rather than recruiting participants from a healthcare setting, these participants are likely to have a lower level of hazardous drinking. In previous QBE studies that have focused on alcohol use only those targeting a student sample found a significant reduction in behaviour.

Study 2 demonstrated that dissonance was a significant predictor of greater biscuit consumption, however this appeared to be due to the relevance of the question (i.e., if individuals don't eat biscuits, they will not worry about levels of consumption; if they do eat biscuits, they are then likely to be more concerned). Study 2 also demonstrated low levels of behaviour reported and therefore individuals were likely to have a lack of motivation to change their health risk behaviours.

The present study will investigate whether questioning social smoking predictions can influence subsequent smoking and drinking behaviour, as well as investigating the influence of questioning alcohol predictions on smoking. The study will also investigate the impact of questioning both behaviours simultaneously on these two connected behaviours. The evidence for the QBE on health risk behaviours is limited and previous findings have been mixed. The present study aims to help to widen our understanding of whether the QBE has an impact on two health risk behaviours that have had little, if any, focus in previous research. The two behaviours (social smoking and alcohol use) often occur in conjunction with one another and by combining the two this could potentially produce a reduction in both self-reported behaviours over one month follow up. Based on previous research investigating the QBE in alcohol use (e.g., McCambridge & Day, 2008; Kypri et al., 2007), along with work suggesting alcohol use and social smoking are linked behaviours (e.g., WHO, 2014) and finally suggestions by Spangenberg et al. (2016) and others that dissonance is key to the QBE, the following are hypothesised.

4.3.1.1 Hypotheses and predictions:

- 1) Completing a prediction questionnaire relating to alcohol use will reduce alcohol use over 1 month compared to control and smoking questionnaire conditions
- 2) Completing a prediction questionnaire relating to social smoking will reduce social smoking over 1 month compared to control and alcohol questionnaire conditions.
- 3) Completing a prediction questionnaire relating to alcohol or social smoking will reduce both behaviours over one month compared to control.
- 4) Experimental conditions will significantly differ to control on the levels of dissonance reported at follow up.

4.3.2 Methods

4.3.2.1 Participants

A priori sample size calculations were conducted prior to recruitment using G*Power, based on an effect of $f = .08$ and a one-way ANOVA with two conditions (experimental vs. control). This suggested that 970 participants were required to provide 80% power to detect a difference between experimental and control conditions (one-tailed). Figure 4.2 shows the CONSORT flow diagram for recruitment into the study. A total of 1272 participants attempted the screening questionnaire, 563 participants were recruited and completed the first questionnaire. Participants were initially screened to assess whether they were a social smoker and drinker. They were only included in the study if they indicated that they smoked mainly with others or as often with other people as alone and also reported that they had previously consumed alcohol. Participants were excluded if they reported that they smoked mainly when alone and/or had never had a drink containing alcohol. Recruited participants were aged 18-73 ($M = 21.83$, $SD = 6.48$), they were recruited from Universities in the UK.

168 participants reported that they were male (20.9%) and 395 (49.3%) reported that they were female, 239 participants (29.8%) did not have their gender recorded due to a computer error. The majority of participants were students ($N = 318$, 64.6%), 45 were recorded as being non-students (5.6%) and 239 (29.8%) did not have their occupation recorded. 432 participants completed the follow up questionnaire emailed one month after completing the initial QBE questionnaire. Participants were rewarded for taking part in the study, initially participants were entered into a prize draw for £50 ($N = 417$,

54.4%), then later due to low levels of recruitment 156 (45.6%) participants were paid a £5 voucher for taking part in both parts of the study.

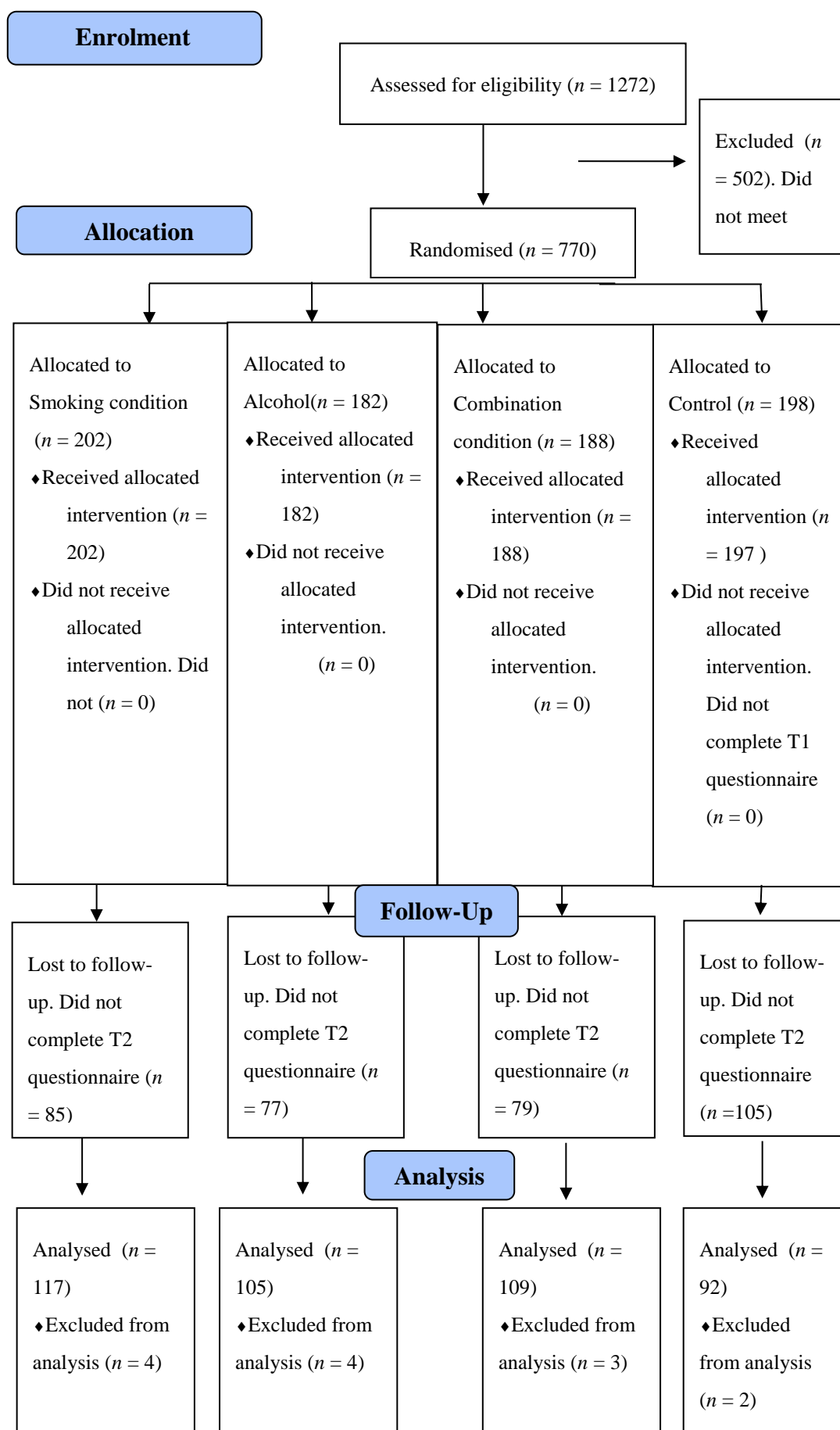


Figure 4.2. CONSORT flow diagram for study 3.

4.3.2.2 Design

The study was an experimental independent groups design study with four conditions; it had three experimental conditions and one control condition. The independent variable was the target behaviour of the prediction questionnaire that participants received. The three experimental conditions manipulated question wording relating to social smoking, social drinking or a combination of both of these behaviours and those in the control condition were asked to predict their likelihood of using the internet in the next week. The primary dependent variable was the performance of smoking and drinking reported one month following completion of the questionnaire. The secondary dependent variable was the level of smoking and drinking performed primarily with other people (i.e., Social smoking/drinking). Also assessed as an additional variable was the degree of dissonance participants experienced when thinking about their biscuit consumption at follow up. This study was approved by the University of Leeds, School of Psychology Ethics Committee (ref: 15-0125).

4.3.2.3 Materials

4.3.2.3.1 Screening.

To assess cigarette use, respondents completed three items to assess smoking frequency and level of dependence using response items based on categories taken from Moran (2004). The first item was designed to assess smoking frequency ('Have you ever smoked a cigarette?' Never used; Used but not in the past 12 months; Used but not in the past 30 days; Used in the past 30 days). The second item was designed to assess social smoking, defined as smoking occurring more with others than when alone ('In the past 30 days, did you smoke mainly when you are with people, mainly when you are alone, or do you smoke as often by yourself as with others?'). The final item was designed to assess levels of nicotine dependence ('How soon after waking do you smoke your first cigarette?' Within 5 minutes, 5-30 minutes, 31-60 minutes, Longer than this, N/A).

Respondents completed three items designed to assess alcohol consumption frequency and amount of alcohol consumed. ('How often do you have a drink containing alcohol?' Never; Monthly or less, 2-4 times a month, 2-3 times a week, 4 or more times a week. 'How many units of alcohol do you drink on a typical day where you are drinking?' 1 or 2 drinks, 3 or 4 drinks; 5 or 6 drinks, 7/8/9 drinks, 10 or more drinks, and 'How often have you had 6 or more units if female, or 8 or more if male, on a

single occasion in the last year?’ Never, Less than monthly; Monthly; Weekly; Daily or almost daily).

Only participants who reported they had smoked in the past 30 days, mainly with other people/equally when alone or with other people, and who also stated that they drank alcohol were randomised to condition and directed to the prediction questionnaires. Due to participants being screened out during the screening questionnaire and therefore not completing the questionnaire to the end, the responses to the screening questionnaire were not recorded.

4.3.2.3.2 Prediction questions:

Smoking. Three prediction items were used, with responses rated on a five point Likert scale (‘Do you predict you will reduce the number of cigarettes you smoke in the next month?’ Definitely not-definitely yes; ‘How likely are you to reduce your smoking in the next month?’ Highly likely-Not at all likely, ‘When you are with friends in the next month do you predict you will reduce the number of cigarettes you smoke?’ Definitely no-definitely yes). Four attitude items were used: (‘Would reducing your smoking in the next month be...’ Bad-Good, Not enjoyable- Enjoyable, Not Worthwhile-Worthwhile, Harmful-Beneficial).

Drinking. The same three prediction and four attitude items were used as in the smoking prediction questionnaire with one key difference; - the target behaviour related to drinking in the next month. (Prediction items: ‘Do you predict you will reduce your alcohol intake in the next month?’ Definitely not-definitely yes; ‘How likely are you to reduce your alcohol intake in the next month?’ Highly likely-Not at all likely; ‘When you are with friends in the next month do you predict you will reduce your alcohol intake?’ Definitely no-definitely yes. Attitude items: ‘Would reducing your alcohol intake in the next month be...’ Bad-Good, Not enjoyable-Enjoyable, Not Worthwhile-Worthwhile, Harmful-Beneficial).

Combined smoking and drinking. The combined condition used the same prediction items as in the individual smoking and drinking questionnaires, it also had the addition of two further items (‘Do you predict you will smoke a cigarette while drinking alcohol in the next month?’ Definitely not-definitely yes; ‘Will you smoke a cigarette when under the influence of alcohol in the next month?’ Definitely not-definitely yes; $\alpha = .93$). The four attitude items related to reducing both alcohol and cigarette consumption in the next month: (‘Would reducing your alcohol and cigarette use in the next month

be...’ Bad-Good, Not enjoyable-Enjoyable, Not Worthwhile-Worthwhile, Harmful-Beneficial; $\alpha = .70$).

Control. Three prediction items and four attitude items were used. These were the same as those used in the Smoking and Drinking conditions, however the focal behaviour related to a neutral behaviour; using the internet in the next month (‘Do you predict you will use the internet in the next month?’ Definitely not-definitely yes; ‘How likely are you to use the internet in the next month?’ Highly likely-Not at all likely; Attitude items: ‘Would using the internet in the next month be...’ Bad-Good, Not enjoyable-Enjoyable, Not Worthwhile-Worthwhile, Harmful-Beneficial; $\alpha = .82$).

4.3.2.3.3 Dependent variables

Both alcohol and smoking (with a focus on smoking with others) levels were assessed over the past month. In an attempt to aid recall participants were asked to indicate the number of cigarettes smoked (even a single drag/puff) and alcoholic drinks consumed for each of the days from the past week. Then they were asked to indicate whether the behaviours were performed with other people or alone. Participants were then asked to indicate the total cigarettes and alcoholic drinks consumed in the past month on weekdays (Monday-Friday) and then indicate the same for week-end days (Saturday & Sunday). They were asked to do this even if they did not smoke the whole cigarette. Due to the limited research into social smoking, there were no previously validated scales available for these behaviours, therefore the scales used were not previously validated. The previously validated timeline follow back measures were not selected to assess behaviour as these were deemed inappropriate due to the intermittent nature of the focal behaviours (Moran et al., 2004). This was also in order to reduce participant burden.

Dissonance. Five items rated on a seven point Likert scale were used to assess the level of dissonance participants experienced when thinking about reducing their smoking and/or alcohol consumption (‘Thinking about reducing my smoking and/or drinking consumption makes me feel uncomfortable’; ‘Thinking about reducing my smoking and/or drinking consumption makes me feel uneasy’; ‘Thinking about reducing my smoking and/or drinking consumption makes me feel anxious’; ‘I worry about reducing my smoking and/or drinking consumption’; ‘The difference between how much I think I should smoke and/or drink and how much I do makes me uncomfortable.’) All

dissonance items were anchored on a seven point scale (Strongly Disagree-Strongly agree; $\alpha = .89$).

4.3.2.4 Procedure

The study was advertised using posters and emails sent to Universities in the UK. Participants were entered into a prize draw at the beginning of the survey recruitment period and then due to low levels of recruitment particularly for the follow up component of the study the recruitment strategy was changed after 5 months so participants were offered a £5 voucher for completing both parts of the survey. Participants were first asked to complete an informed consent form online and were then directed to complete the screening questions. Eligible participants were then randomised to condition via a random number generator whereby they were forwarded to one of the four questionnaires asking them to predict their future behaviour.

After one month participants were emailed the link to the follow up questionnaire and were asked to report their drinking and smoking behaviour in the past month, along with identifying social smoking occasions over the past week. Participants were also asked to report cognitive dissonance when thinking about the focal behaviour. After completing the follow up questionnaire participants were fully debriefed.

4.3.2.5 Analyses Methods

The data were analysed first to check randomisation was successful and then to assess skewness of the data. Parametric tests were conducted on the data initially where the effects of the manipulation on behaviour were assessed using separate hierarchical ANOVAs with one factor (Condition: Experimental vs. control) and 3 nested levels for the experimental group. The effect of condition on dissonance ratings was then assessed. Data were then re-analysed using non-parametric assumptions. Due to the lack of significant findings the parametric results for each dependent variable are presented; the non-parametric analyses are only presented for variables that were found to be significant under parametric assumptions.

4.3.3 Results

4.3.3.1 Randomisation checks

Randomisation of participants to conditions was successful for the study. There were no differences between any of the four conditions for age, $F(3, 559) = 1.73, p = .16$, gender $\chi^2(3, N = 563) = 2.78, p = .43$ or occupation $\chi^2(3, N = 563) = 2.36, p = .50$.

Skewness of data was analysed for each of the key dependent variables; each of the dependent variables was found to be significantly skewed in that the skewness statistic was greater than 1.96 for all dependent variables.

4.3.3.2 Condition effects on dependent variables

4.3.3.2.1 Total cigarettes: Over month

The total number of cigarettes smoked over the past month was calculated. After the removal of 10 outliers (defined as z score value $>2/<-2$) this ranged from 0–426 cigarettes smoked ($M = 58.07$, $SD = 88.34$). The difference between experimental (Smoking, Drinking, Combined) and control conditions was found to be not significant, $F(1, 408) = 2.08$, $p = .15$. There was also no effect of the nested levels of the experimental condition, $F(2, 408) = .35$, $p = .71$. The highest number of cigarettes were smoked by people in the Smoking condition ($M = 67.50$, $SD = 99.79$), followed by the Drinking condition ($M = 57.62$, $SD = 99.03$), and Combination condition ($M = 56.44$, $SD = 83.03$), the fewest cigarettes were smoked in the control condition ($M = 42.41$, $SD = 58.56$).

4.3.3.2.2 Total cigarettes: Past week

After the removal of 12 outliers, the total number of cigarettes smoked over the past week ranged from 0-113 ($M = 14.95$, $SD = 23.52$). The total cigarettes smoked over the past week did not significantly differ between experimental and control conditions, $F(1, 407) = 3.70$, $p = .06$. The highest number of cigarettes were smoked in the Smoking condition ($M = 67.50$, $SD = 99.79$; Drinking $M = 57.62$, $SD = 99.03$; Combination $M = 56.44$, $SD = 83.03$) compared to Control ($M = 42.41$, $SD = 58.56$), supporting a greater number of cigarettes reported in the three experimental conditions compared to control.

There was also no effect of the nested levels of the experimental condition, $F(2, 407) = .69$, $p = .50$. The greatest number of cigarettes were reported to be smoked in the past week were in the Smoking condition ($M = 17.63$, $SD = 27.85$), followed by the Drinking condition ($M = 17.01$, $SD = 28.34$), Combination condition ($M = 14.08$, $SD = 20.06$), the fewest cigarettes were smoked in the Control condition ($M = 10.76$, $SD = 14.64$). Significantly more cigarettes were smoked in the Smoking condition compared to control ($p = .04$), no other significant differences were found between conditions. The data were found to be significantly negatively skewed ($p < .001$) and when the

significant analysis was repeated using the non-parametric Kruskal-Wallis test the difference was no longer significant, $\chi^2(df=1) = .06, p = .81$.

4.3.3.2.3 Social smoking over the past 7 days

The total number of days participants engaged in social smoking over the past week was calculated ($M = 1.87, SD = 2.01$). The difference between experimental and control conditions was not significant, $F(1, 402) = .04, p = .85$. There was also no effect of the nested levels of the experimental condition, $F(2, 402) = .57, p = .56$. Those in the Smoking condition performed social smoking most frequently ($M = 1.98, SD = 2.25$), followed by the Combination condition ($M = 1.92, SD = 1.92$), the Control condition ($M = 1.82, SD = 1.84$), those in the Drinking condition socially smoked on the fewest number of days over the past week ($M = 1.70, SD = 1.93$).

4.3.3.2.4 Total drinks consumed: Over month

The total number of alcoholic drinks consumed over the past month was calculated, after the removal of seven outliers this had a range of 0-134 drinks consumed ($M = 37.37, SD = 27.51$). The difference between experimental and control conditions was not significant, $F(1, 413) = .10, p = .75$. There was also no effect of the nested levels of the experimental condition, $F(2, 413) = .79, p = .46$. The greatest number of drinks consumed in the past month were in the Combination condition ($M = 39.89, SD = 28.96$) followed by the Control condition ($M = 38.24, SD = 25.66$) and Smoking condition ($M = 36.39, SD = 28.96$), the fewest alcoholic drinks consumed were consumed in the Drinking condition ($M = 35.29, SD = 26.24$).

4.3.3.2.5 Total drinks consumed: Past week

The total number of alcoholic drinks consumed over the past month was calculated, after the removal of six outliers this ranged from 0-33 drinks ($M = 9.74, SD = 7.60$) and the difference between experimental and control conditions was not significant, $F(1, 413) = .44, p = .51$. There was also no effect of the nested levels of the experimental condition, $F(2, 413) = 1.28, p = .28$. The greatest number of drinks consumed in the past month were in the Combination condition ($M = 10.48, SD = 7.97$), Control condition ($M = 10.24, SD = 7.21$) followed by the Smoking condition ($M = 9.65, SD = 8.14$), the fewest alcoholic drinks were consumed in the Drinking condition ($M = 8.80, SD = 7.01$).

Table 4.2 Means (SDs) for dependent variables in each condition

	Condition Means (SD)			
	Smoking	Drinking	Combination	Control
Total cigarettes: Past month	67.50 (99.79)	57.62 (99.03)	56.44 (83.03)	42.41 (58.56)
Cigarettes: Past week	17.63 (27.85) _a	17.01 (28.34) _{ab}	14.08 (20.06) _{ab}	10.76 (14.64) _b
Social smoking days	1.98 (2.25)	1.70 (1.93)	1.92 (1.92)	1.82 (1.84)
Total drinks: Past month	36.39 (28.96)	35.29 (26.24)	39.89 (28.96)	38.24 (25.66)
Total drinks: Past week	9.65 (8.14)	8.80 (7.01)	10.48 (7.97)	10.24 (7.21)
Social drinking days	2.04 (1.39) _a	2.02 (1.44) _a *	2.50 (1.68) _b *	2.29 (1.40) _{ab}
Smoking Prediction	3.07 (1.19)		2.32 (1.01)	
Alcohol Prediction		2.47 (1.05)	3.19 (1.25)	
Dissonance	2.92 (1.50)	2.78 (1.54)	2.85 (1.40)	2.85 (1.40)

_{ab} Differing postscripts indicate significant differences from parametric analyses *

Indicate significant differences from non-parametric tests.

4.3.3.2.6 Social drinking over the past 7 days

The total number of days participants engaged in social drinking was calculated and six outliers were removed from the data ($M = 2.23$, $SD = 1.50$). The difference between experimental and control conditions was not significant, $F(1, 407) = .36$, $p = .55$. There was, however, a significant effect of the nested levels of the experimental condition, $F(2, 407) = 3.60$, $p = .03$. The Combination condition performed social drinking most frequently ($M = 2.50$, $SD = 1.68$), followed by the Control condition ($M = 2.29$, $SD =$

1.40); the Smoking condition ($M = 2.04$, $SD = 1.39$), and the Drinking condition socially drank on the fewest number of days over the past week ($M = 2.02$, $SD = 1.44$). Specific group comparisons showed that social drinking was significantly greater in the Combination condition compared to both the Smoking condition ($p = .02$) and Drinking condition ($p = .02$). The data were found to be significantly negatively skewed based on performing a Shapiro-Wilk test ($p < .001$). When these analyses were repeated using the non-parametric Kruskal-Wallis test, the difference between Drinking and Combination conditions was found to be still significant, $\chi^2(df = 1) = 4.19$, $p = .04$. However the difference between Smoking and Combination conditions was found to be no longer significant, $\chi^2(df = 1) = 2.92$, $p = .09$.

4.3.3.2.7 Condition x Dissonance

Dissonance was rated on a seven point scale, where a higher score indicated greater levels of psychological discomfort when thinking about social smoking and drinking. A mean dissonance score was then calculated ($M = 2.84$, $SD = 1.47$). A hierarchical ANOVA found that dissonance was rated highest in the Smoking ($M = 2.92$, $SD = 1.50$) and Control ($M = 2.85$, $SD = 1.40$) conditions, while dissonance was rated lowest in the Alcohol ($M = 2.78$, $SD = 1.54$) and Combination ($M = 2.85$, $SD = 1.40$) conditions. No differences were found between experimental and control conditions, $F(1, 419) = .01$, $p = .91$ or the three experimental conditions, $F(2, 419) = .34$, $p = .71$, for the levels of dissonance experienced when thinking about alcohol and cigarette use.

Condition and dissonance were then both entered into a regression, with total cigarettes as the dependent variable. Condition was not found to be a significant predictor of cigarette smoking over the past month ($\beta = .07$, $p = .14$), dissonance was a significant predictor of cigarette smoking ($\beta = .43$, $p < .001$). The regression was then repeated with the interaction between condition and dissonance entered into a second step of the regression. Condition was still a non-significant predictor ($\beta = .07$, $p = .14$), dissonance remained a significant predictor ($\beta = .26$, $p = .01$), and the interaction between these was not significant ($\beta = .19$, $p = .06$). This suggests that higher levels of reported dissonance predicted greater cigarette smoking but that dissonance levels were not related to condition.

The regression was then repeated with drinking behaviour over the past month as the dependent variable. This found that none of the predictor variables entered predicted

drinking behaviour (Condition: $\beta = -.004, p = .94$; Dissonance $\beta = .17, p = .12$; interaction between condition and dissonance $\beta = -.09, p = .44$).

4.3.3.2.8 Sensitivity analysis

Although participants were screened and only included if they performed both smoking and drinking more often with others than alone, or equally alone as with others, there were participants who smoked more than the 1-4 cigarettes per day that has been suggested as low level smoking (Schane, Ling, & Glantz, 2010). The data were re-analysed on just smokers who reported smoking fewer than 28 cigarettes per week, or 120 cigarettes or fewer per month. In these participants, weekly smoking was found to be lowest in the Drinking condition ($M = 4.01, SD = 6.12$) followed by the Smoking condition ($M = 4.79, SD = 7.01$), and the combination condition ($M = 5.37, SD = 7.37$), the greatest number of weekly cigarettes smoked were reported in the control condition ($M = 5.39, SD = 7.09$). However there was no significant difference between experimental and control conditions, $F(1, 324) = .53, p = .47$, or the nested levels of the experimental conditions $F(2, 324) = .79, p = .46$.

This non-significant pattern was also found in monthly smoking for the difference between experimental and control conditions $F(1, 327) = 1.03, p = .31$, or the nested levels of the experimental conditions $F(2, 327) = 2.35, p = .10$. When comparing the conditions individually, significantly more cigarettes were smoked in the Combination condition ($M = 23.62, SD = 32.36$) compared to the Drinking condition ($M = 14.41, SD = 18.32$), $p = .03$. However when a non-parametric Kruskal-Wallis test was conducted on this comparison, it was no longer significant $\chi^2(df = 1) = .14, p = .71$.

Seventy eight participants reported no smoking over the past month. When these participants were removed from the analysis, no significant differences between QBE and control conditions were found for the total number of cigarettes smoked over the past month, $F(1, 329) = 3.37, p = .07$, there were also no effects of the nested levels in the experimental condition, $F(1, 329) = .61, p = .55$. When comparing the conditions individually this showed only one significant difference, where the smoking condition smoked significantly more cigarettes compared to control ($p = .03$).

This was repeated for the total cigarettes smoked over the past week. This analysis found a significant difference between experimental and control conditions $F(1, 329) = 4.78, p = .03$, but no significant effect of the nested experimental levels $F(2, 329) = .46, p = .63$. Comparing the conditions individually showed that significantly more

cigarettes were smoked in the Smoking compared to control ($p = .02$) conditions. The analyses on the two key drinking dependent variables (past month drinking and past week drinking) were then repeated when excluding the 24 participants who had not consumed any alcohol in the past month; any condition differences remained non-significant.

4.3.4 Discussion

Study 3 aimed to investigate the impact of asking prediction questions relating to social smoking and drinking in individuals who performed these two behaviours, over one month follow up. The key findings from study 3 support mainly non-significant effects of asking individuals to predict future social smoking and drinking behaviour on these behaviours. The results appear to support a small and inconsistent effect of the QBE on behaviour; this was in the opposite direction to that required when applying the QBE as a behaviour change intervention. The QBE appears to have encouraged greater cigarette smoking in those individuals specifically asked about this behaviour, rather than reducing it. Although this increase in behaviour was not consistently found across the measures of behaviour. Social drinking was also highest in the Combination condition questioned on both smoking and drinking behaviour and lowest in those asked only about predictions toward drinking alcohol only. No significant effects were found on overall smoking, social smoking over the past week or smoking separated by weekend and weekdays. The hypotheses, that the QBE would produce a reduction in smoking and drinking behaviour as a result of questioning, were not supported.

Despite the screening participants were exposed to, a high proportion of participants reported smoking and drinking behaviour above what would be expected following the definition of social smoking by Schane, Glantz, and Ling (2009) along with other authors in this field (e.g., Bjartveit & Tverdal, 2005). Further analyses were conducted whereby only participants who reported smoking fewer than 28 cigarettes per week. This found no significant QBE effect on behaviour in this subsample. These analyses was then repeated when excluding all of the individuals who had not smoked in the follow up month, conducted due to the intermittent nature of the behaviour to remove individuals not regularly be involved in the focal behaviours. These analyses again found that individuals in the Smoking condition reported smoking significantly more cigarettes compared to the Control group.

There are a number of potential explanations for the results found in the present study. First, the data were found to be significantly skewed. When non-parametric tests were applied to the data only the difference between Combination and Drinking conditions on social drinking days remained significant. Second, the dissonance levels reported in the present study were very low. Participants may have had a generally low motivation to change behaviour. Dissonance was found to be a significant predictor of smoking, but not of drinking behaviour. This was similar to the finding from study 2 which found that higher levels of dissonance predicted higher levels of biscuit consumption. This is in the opposite direction to that expected, where it would be expected that participants reporting higher levels of dissonance would smoke fewer cigarettes. However, the measure of dissonance was the same as that used in study 2 and was one that had not previously been validated. In both the present study and study 2 the study was not advertised as a behaviour change intervention in order to reduce any reactance effects. If participants were recruited who wished to change their social smoking and drinking behaviour, the QBE could potentially have been more influential.

The evidence on characteristics of social smokers appears to be mixed, with some studies suggesting low use of cigarettes and social smoking are associated with high intentions to quit (Song & Ling, 2011). Other studies support social smokers as having low intentions to quitting smoking (Moran, Wechsler, & Rigotti, 2004) and suggest that participants may not be aware of the negative health consequences associated with low levels of smoking. In the present study, participants' attitudes toward reducing social smoking were on the positive end of the scale however their predictions toward reducing behaviour were around the midpoint of the five point scale. This therefore supports Moran, Wechsler, and Rigotti (2004) more than Song and Ling (2011), although the present study did not specifically assess intentions but instead likelihood of reducing smoking/ drinking. Future studies should focus on increasing awareness to the negative effects of low level smoking in order to increase motivation to change behaviour.

The QBE intervention in the present study, along with the intervention presented in study 2, only asked a small number of prediction questions. Evidence from the meta-analysis in Chapter 2 did not support the number of questionnaire items as a significant moderator, studies have produced a significant QBE using only single item questions (e.g., Chapman, 2001; Fitzsimons, Nunes, & Williams, 2007). However, the present study followed behaviour over one month. The meta-analysis also supported the QBE

having a decreasing effect over time. It may be the case that the influence of just three prediction questions is too minor to have an impact over long term follow up.

There are a number of limitations of the present study that may have contributed to the lack of effect found, and that limit the applicability of the study findings. Firstly the data were significantly negatively skewed, although this was expected due to the low levels of behaviour expected within this sample, this limits the application of parametric tests to this kind of data. Previous studies have produced inaccurate conclusions based on the use of parametric tests on skewed data (e.g., Williams, Block, & Fitzsimons, 2006). This suggests that studies of the QBE need to be wary of potential issues with low levels of behaviour, particularly if they are investigating health risk behaviours which may not be performed as regularly as certain protection health behaviours (e.g., eating fruit and vegetables; physical activity). There is a potential for Type II error when using non-parametric tests as these tend to be less powerful than parametric tests (Dallal, 2012).

A second limitation is that although 1272 participants underwent the screening process for the study, only 770 of these met the screening criteria and then just 423 participants completed the follow up. This meant that only half the required participants were recruited and provided follow up data of the participants required to provide 80% power. Unfortunately the responses from participants completing the screening questionnaire were not stored so it is not possible to analyse whether the majority of participants were screened out due to being non-smokers or due to being non-social smokers.

Finally, a third issue is that the measures used in the study, both for the dissonance measure and also the outcomes measures, were not previously validated. This was due to there being a lack of appropriate and validated measures to assess dissonance levels and to reduce participant burden at follow up. The dissonance questions used in the present study were modified from the scale used in study 2, and although both scales provided good internal validity ($\alpha = .89 - .95$) these have not been validated as specifically targeting dissonance. In addition to this, the outcome measures of smoking and drinking were not previously validated. Validated measures such as the Timeline Follow Back questionnaire (Sobell et al., 1996) were not selected mainly in an attempt to reduce participant burden and encourage responding at time 2. This was also in part due to the intermittent nature of the dependent variable behaviours. Future research on the QBE would benefit from using pre-validated measures of behaviour. It would also

be beneficial to develop validated measures of non-regular behaviours such as social smoking.

Study 3 aimed to investigate the influence of predicting future likelihood of reducing social smoking and drinking behaviour on subsequent performance of these behaviours over one month follow up. The study also aimed to investigate whether questioning combined behaviours that are known to be performed together would increase the effect of asking about individual behaviours. Low responding to follow up meant the study was underpowered; the data were also negatively skewed. The findings appear to support asking individuals to predict both social smoking and drinking produced a greater incidence of social drinking days over the past week than asking drinking predictions alone. Low levels of dissonance were reported and it was likely that, similar to study 2, participants had low motivation to change their behaviour. Further studies are required that could investigate the influence of measuring multiple behaviours on subsequent performance of these behaviours. Studies would also benefit from being sufficiently powered to detect a difference between conditions. It would also be beneficial to investigate the influence of dissonance and whether this can be manipulated in order to assess any affect of this over the QBE.

4.4 Study 4. The QBE in multiple protection and health risk behaviours

Most of the research into the QBE reviewed in Chapter 2 has targeted a single focal behaviour and there have been limited studies to investigate the impact of the QBE on multiple behaviours simultaneously. The evidence from study 3 suggests that asking about multiple behaviours may produce an effect on one, but not both of these behaviours at follow up. Study 3 also supports the QBE increasing, rather than a reducing, health risk behaviours. Health behaviours do not occur in isolation, and it is likely that behaviours are performed, or are risked, concurrently (e.g., Poortinga, 2007). Chapter 1 highlighted the broad categories of health behaviour key to influencing morbidity and mortality. Many of these behaviours are interconnected, for example consuming an unhealthy diet is also often associated with low levels of physical activity (Harris & Bargh, 2009). Study 4 aimed to investigate applying the QBE to multiple protection and health risk behaviours and the influence of this over behaviour at four week follow up.

One previous published study investigated the QBE across multiple health behaviours. Lawrence and Ferguson (2011) investigated the impact of assessing intentions and past behaviour in relation to quitting cigarette smoking, reducing alcohol use, performing safe sex, driving safely, dieting, and exercising. Participants who received a QBE questionnaire were compared against a comparison group given no questionnaire at two month follow up. Self-reported behaviour was found to be significantly different for alcohol use at follow up, where the QBE participants reported drinking less alcohol compared to control. No other significant differences were found.

Since health behaviours are typically not performed in isolation (Harris & Bargh, 2009), it may be the case that asking about multiple behaviours influences each of these behaviours, particularly if cognitive dissonance is induced through questioning. Questioning multiple behaviours at one time may induce a general awareness of discrepancies between overall behaviour and the expectation to lead a healthy lifestyle. Alternatively it may be the case that questioning multiple behaviours dilutes any potential QBE as the individual is forced to consider their cognitions relating to a number of behaviours at once. This may explain the single effect produced in the Lawrence and Ferguson (2011) paper.

4.4.1 Focal behaviours

The focal behaviours chosen in the present study aim were selected for two key reasons. First, behaviours were considered if they fell under the broad categories suggested to be important to mortality and morbidity in Chapter 1 (i.e., unhealthy diet, low levels of physical activity and high levels of sedentary behaviour, abusing substances including alcohol and cigarettes, and engaging in risky sexual behaviours). Second, behaviours were selected based on the likely prevalence of performing behaviour within the online sample used as participants. The study used Prolific Academic, a database with a majority US and UK based participants with an age range of 16-75 (a majority of participants 18-35), 62% of the database are male and 38% are reported as female.

Lawrence and Ferguson (2011) reported the only QBE study to investigate the impact of assessing intentions and past behaviour in relation to multiple health behaviours (quitting cigarette smoking, reducing alcohol use, performing safe sex, driving safely, dieting, and exercising). In this study, participants who received a QBE questionnaire were compared against a comparison group given no questionnaire at two-month

follow up. Self-reported behaviour was found to be significantly different for alcohol use only; at follow up the QBE participants reported drinking less alcohol compared to control. However, Lawrence and Ferguson's (2011) did not use an RCT design, and recruited University students as participants, and was under-powered. Further tests are therefore warranted. The present study used a large and diverse online sample with the sample size calculated a-priori on the basis of the results Chapter 2. Chapter 2 also highlighted the potential for risk of bias effects for research in this area, where greater effects were observed in QBE rated at higher risk of bias than studies with lower risk of bias. The present study aims to minimise risk of bias by using an online method where participants are blinded and allocation to condition is concealed and there is no one-to-one interaction with the experimenter.

4.4.1.1 Diet.

An unhealthy diet, with high levels of low-nutrient, high calorie foods, particularly when combined with sedentary behaviour, is associated with overweight and obesity (Harris & Bargh, 2009). Recent trends in snacking suggest that this behaviour has increased over the past four decades or so, where the percentage of adults consuming snacks increased 26% from 71% in 1977-1978 to 97% in 2003-2006 (Piernas & Popkin, 2010). Yet, fruit and vegetable consumption is associated with reduced cancer cardiovascular mortality (Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014) and the World Health Organisation recommend that individuals consume >400g per day. However, in the UK only just over half of this are consumed on average and it is estimated that over half of individuals in European countries consume less than half of the recommended levels (WHO, 2006).

4.4.1.2 Physical activity.

Physical activity and exercise are also hugely important modifiable health behaviours. Being active or fit has been associated with 50% reduction in risk of death and in particular is associated with lower risk of cardiovascular disease (Myers et al., 2004). Protective effects of small acts of activity including walking for one hour a week have been associated with lower risk of cardiovascular related death (Oguma & Shinoda-Tagawa, 2004). In the USA only 48% of people meet recommended guidelines (CDC, 2014). In the UK recommended levels are at least 150 minutes per week in moderately intensive physical activity, in bouts of ten minutes or longer, or 75 minutes per week of vigorous physical activity, or a combination of the two. Despite this in 2012, only 67%

of men and 55% of women aged 16 and over met these new guidelines (HSCIC Statistics on Smoking 2016). Also, while physical activity is associated with a reduction in morbidity, physical inactivity is also an important and modifiable risk factor for cardiovascular disease and a wide range of different physical and mental health problems. It has the highest prevalence of all health risk behaviours (Warburton, Nicol, & Bredin, 2006); in 2005, 23.7% of USA adults reported no leisure time activity (CDC, 2005).

4.4.1.3 Excessive alcohol use.

Despite the negative consequences of regular excessive drinking including cancers, stroke, heart disease and liver disease (National Institute of Alcohol Abuse and Alcoholism, 24% of adults in England exhibit hazardous drinking (National Health Survey, 2011).

4.4.1.4 Tooth flossing.

Finally, according to NHS Choices and CDC (2013), daily tooth flossing helps to prevent gum disease by reducing plaque build-up. However, only 21% of adults report flossing regularly (HSCIC, 2011).

These six behaviours: consuming 5 fruit and vegetables a day, performing recommended levels of physical activity, tooth flossing, not drinking more than recommended amounts of alcohol, not performing excess sedentary behaviour, and not consuming unhealthy snacks are associated with a healthy lifestyle and lower levels of associated morbidity and mortality. Some of these behaviours (e.g., alcohol consumption) are more influential over health than others (e.g., tooth flossing). Behaviours were also selected to those that have potential to be performed fairly frequently in that they would be performed over the course of the following month selected for study follow up.

4.4.2 Dissonance

One potential explanation for the lack of significant QBE influences on studies 2 and 3 reported in the present chapter could be due to the low levels of self-reported dissonance participants experienced relating to the focal behaviours when this was questioned at follow up, suggesting participants may have had low motivation to change to risk this negative state. No study to date has attempted to combine manipulations of both the QBE and dissonance despite the potential influence of

dissonance as a key mechanism underlying the QBE (see Chapter 2; Spangenberg et al., 2016). Manipulating dissonance alongside QBE questions may increase the influence of questioning on behaviour as this would aim to increase the aversive reaction participants experience as a result of questioning and therefore motivate them to change levels of behaviour, when compared to a QBE alone condition and control. The present study manipulated the instructions provided to participants in an attempt to indirectly manipulate the level of cognitive dissonance experienced by participants as a result of questioning. Highlighting to participants the importance of performing the behaviours and generally living a healthy lifestyle is likely to increase the levels of dissonance experienced as a result of answering the questions and therefore make them more likely to act in a socially desirable direction (i.e., Perform risk behaviours less frequently and protection behaviours more frequently). In addition to this, three dissonance items were included at the end of the questionnaire. These aim to emphasize the accuracy of participants' own reporting. These questions should emphasize participants' own potential to have inaccurately reported their cognitions and therefore increase the potential dissonance experienced when reporting their levels of behaviour.

4.4.3 Self-monitoring

One factor that has been previously supported as a moderator of the QBE is self-monitoring. Snyder (1979) first defined self-monitoring as the influence that situational and dispositional factors have on behaviour. Individuals high in self-monitoring are influenced more by situational factors and are more likely to act in a way that they perceive as more socially-adjustive, whereas low self-monitors are more affected by their own internal states and are less affected by other people (Nyer & Dellande, 2010). A high self-monitor is more likely to be flexible in their behaviour and to act in a way that they believe will provide a favourable impression on another individual, whereas a low self-monitor is more likely to act in accordance with their own cognitions regardless of the situation.

Spangenberg and Sprott (2006) provided support for the moderating effect of self-monitoring on the QBE. They found there was no effect of the QBE in high self-monitors, potentially because they are less affected by their internal states- the cognitive dissonance that is suggested to act as a motivator toward behaviour in the QBE, so these individuals do not feel so motivated to act in accordance with their stated intentions. The QBE was found to affect low self-monitors, so these findings

support low self-monitors being motivated to act in accordance with their cognitions and therefore more likely to be influenced by the QBE.

4.4.4 Aims

The study aimed to investigate the influence of the QBE on three protection health and three health risk behaviours using an online questionnaire based on the Theory of Planned Behaviour (TPB; Ajzen, 1991). The study also aims to investigate the influence of manipulating dissonance. This manipulation is via an altered introduction emphasising the importance of behaving healthily, along with the addition of three dissonance items which aim to highlight any inaccuracies in participants' responding. Self-reported behaviour over the past four weeks will be assessed four weeks after the baseline questionnaire completion.

The present study assessed the influence of the QBE over four week follow up. This aimed to provide a better understanding of the influence of the intervention on a range of behaviours over time. As stated previously, the behaviours were selected in part because individuals who engage in them are likely to perform them at least once over the follow up. However, it is likely that not all participants will regularly engage with all six behaviours.

The present study will add to the literature in the following ways. First, it will advance the QBE literature in relation to applying this intervention to multiple behaviours at once, something that to date only one published study has done. Second, the study aims to advance knowledge regarding the QBE when applied simultaneously to protection and health risk behaviours in order to assess what direction of effect, if any, is produced as a result of questioning individuals' cognitions and past behaviour. Third, it aims to investigate the influence of cognitive dissonance over the QBE by manipulating this in one of the conditions. This aims to assess whether manipulating dissonance enhances the QBE. Finally, the study also aims to investigate the QBE again within an online setting. This allows recruitment of large sample sizes to sufficiently power the study, and extends the previous findings from the present chapter in order to assess whether the QBE produces a change in health risk behaviours when questioning is administered online.

Based on previous findings in relation to the QBE in protection health behaviours (e.g., Ayres et al., 2013) and the one previous study on multiple health behaviours which

produced a decrease in alcohol consumption (Lawrence & Ferguson, 2011). The following are hypothesised:

- 1) Asking cognition and behaviour questions about increasing protection health behaviours will promote performance of these behaviours compared to control;
- 2) Asking cognition and behaviour questions about reducing health risk behaviours will decrease performance of these behaviours compared to control;
- 3) Manipulating dissonance will enhance the QBE; participants in the dissonance condition will perform (a) protection health behaviours more frequently and (b) health risk behaviours less frequently compared to either the QBE-only or control conditions.

4.4.5 Method

4.4.5.1 Participants

Participants were recruited via Prolific Academic, an online database of participants interested in taking part in a variety of different types of research from a range of academic areas. From a database of approximately 26,000 potential participants 1965 individuals were recruited and completed part 1 of the study. A priori sample size calculations using G*Power were conducted based on average effect sizes for QBE studies conducted for health behaviours and studies using an online setting, from Wood et al. ($d = .29; f = .145$) and studies using online setting from Chapter 2 ($g = .05; f = .025$, average $d = .17, f = .085$). To produce 80% power and based on a one-way ANOVA including three conditions, 1338 participants were required. Participants were provided with £4.30 for completing both parts of the study.

1565 completed the follow up and 1531 of these were able to be matched to time 1 data (20% attrition rate). Participants ages ranged from 18-75 years ($M = 31.47, SD = 11.09$), 977 participants were male (49%), and 958 were female (48.1%), 22 reported their gender as non-binary (1.1%). The majority of participants reported their ethnicity as Caucasian ($N = 1416, 71.1%$), 165 participants reported they were South Asian (8.3%), 108 participants reported they were East Asian (5.4%), 74 participants reported as mixed race (3.7%), 64 participants reported as 'Other' ethnicity (3.2%), 36 participants reported as African ethnicity (1.8%). Table 4.3 shows key demographic details of individuals at Time 2, separated by condition.

The majority of participants reported having an Undergraduate degree ($N = 756, 38%$), or post-secondary education such as A-Levels ($N = 416, 20.9%$), 348 participants

reported as having a postgraduate degree (17.5%), 235 participants had completed secondary education such as GCSE/O-Levels (11.8%), 179 participants had completed a vocational qualification (9.0%) and 13 participants had no official schooling completed (.7%). A majority of participants worked full time ($N = 895$, 44.9%), or were in full-time education ($N = 345$, 17.3%), 255 participants reported they were self-employed (12.8%), 160 were not currently working (8%), 101 were a housewife/househusband (5.1%), 93 participants worked part time (4.7%), 43 were in part-time education (2.2%) and 39 participants reported they were retired (2.0%).

Participants completed two SES ladders on a 10 point scale based on where they considered they stood in society, or in the community. A higher score out of 10 indicated they saw themselves as higher in either society or in the community. On the SES society ladder, the majority of participants reported they considered themselves at point 5 ($n = 520$, 26.1%), followed by: point 6 ($n = 388$, 19.5%), point 4 ($n = 383$, 19.2%), point 7 ($n = 275$, 13.8%), point 3 ($n = 147$, 7.4%), and point 8 ($n = 144$, 7.2%). The SES community ladder was rated on the same 10 point scale. The majority of participants reported they considered they were at point 6 ($n = 444$, 22.3%), point 5 ($n = 426$, 21.4%), point 4 ($n = 345$, 17.3%), point 7 ($n = 272$, 13.7%), point 3 ($n = 164$, 8.2%), and point 8 ($n = 152$, 7.6%).

4.4.5.2 Design

An independent groups design was used with three conditions: (1) Regular QBE (questionnaire based on the TPB), (2) QBE plus dissonance manipulation, (3) Control (questions related to purchasing behaviour). The dependent variable was self-reported performance of each of the six behaviours over the past four weeks. Secondary dependent variables were reported intentions relating to behaviour at four week follow up, and purchasing behaviour over the past four weeks. All purchasing behaviours questioned in the control condition were selected to reduce confounding with health behaviour (they did not encourage specific food purchases, physical activities, or sedentary behaviour). The questionnaire order was counterbalanced so that participants in the experimental condition were randomly allocated to either receiving the questions on health-promotion behaviours first or were allocated to receiving the health-risk questions first. The study was approved by the University of Leeds, School of Psychology Ethics Committee (ref: 16-0157).

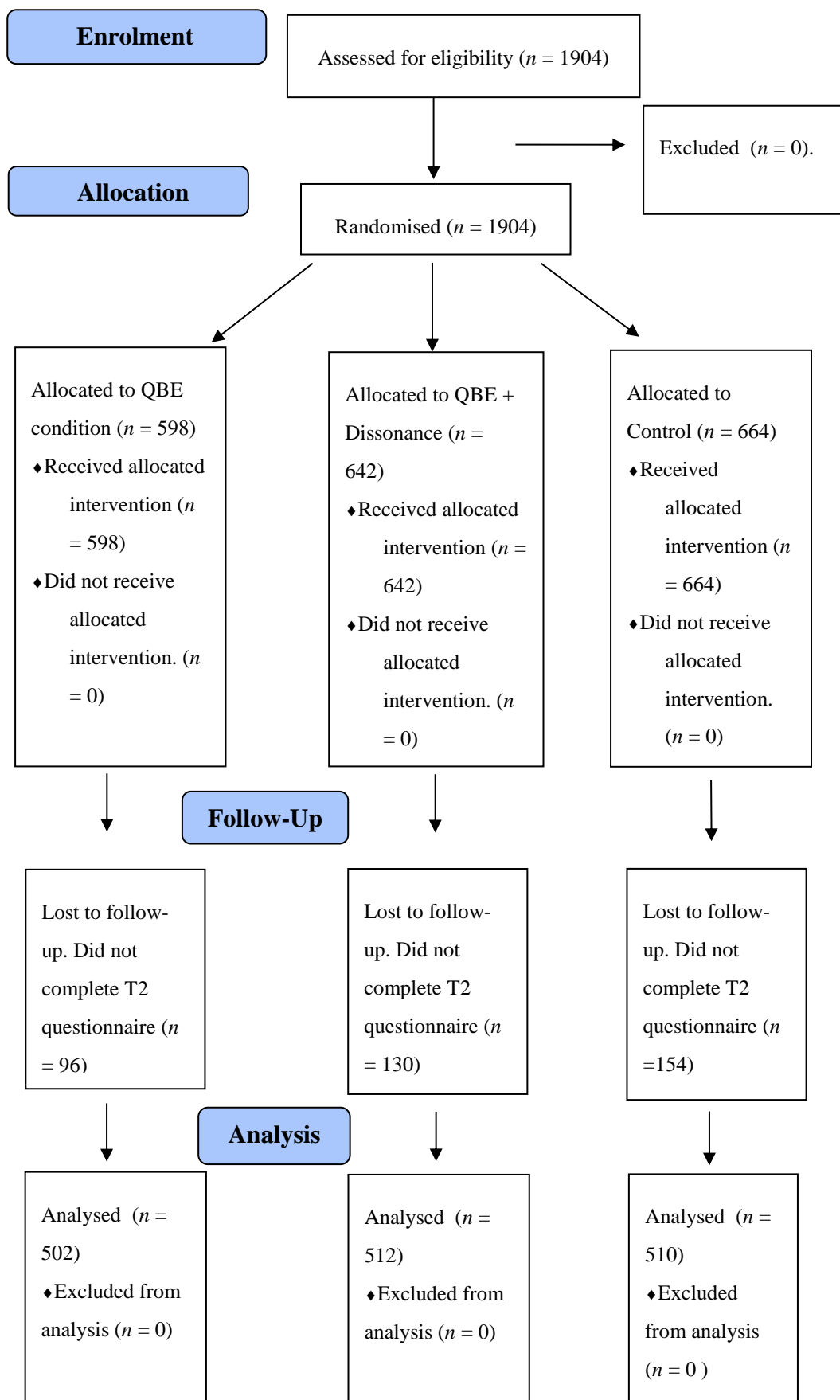


Figure 4.3. CONSORT flow diagram for study 4.

All participants were questioned on their demographics. This included age, gender, nationality, ethnicity, occupation, and Socio Economic Status (SES).

4.4.5.2.1 Health Behaviour questionnaire.

Participants in both experimental conditions received the health behaviour questionnaire. This included a total of 108 items, 15 cognition items for each of the six health behaviours (eating fruit and vegetables, performing recommended levels of physical activity, flossing daily, not drinking over recommended levels per week, not sitting for extended periods of time, not consuming unhealthy snacks), plus three past behaviour items for each behaviour presented at the end of the questionnaire. Each behaviour was introduced and defined at the start of the set of questions. Questions were based on items from previous Theory of Planned Behaviour questionnaires and asked participants to complete a 7 point Likert scale relating to performing behaviour over the next four weeks, all questions were anchored from Strongly agree-Strongly disagree unless where specifically stated. The questionnaire design was based on previous guidance for creating TPB questionnaires (Conner & Sparks, 2015).

The following cognitions were tested, each question related to behaviour per day: Four intention items (“I am likely to”, “I intend to”, “I want to”, “I feel I should”...”eat five portions of fruit and vegetables per day over the next four weeks”); One expectation item (“How many portions of fruit and vegetables would you expect to consume per day over the next four weeks”); One self-efficacy item (“If it were entirely up to me, I am confident that I could...”); One perceived behavioural control item (“How much control do you believe you have over” No control-complete control); Four attitude items (“Eating five fruit and vegetables a day over the next four weeks would be”... Worthwhile-Worthless; Not enjoyable-Enjoyable; Important-Unimportant; Unpleasant-Pleasant); One injunctive norm item (“Most people important to me think that...” I should-I should not); One descriptive norm item (“I think that most people who are important to me...”); One goal setting item (“I would prioritise eating at least 5 portions of fruits and vegetables per day over other goals important to me”); One context stability item (“Is eating five portions of fruit and vegetables a day something that you do at the same times and in the same places each time?” Definitely No–Definitely Yes).

Participants were also asked to report the number of times they had performed each of the six behaviours per day over the past four weeks. This was assessed using three past behaviour questions for each behaviour; (“How often do you eat five portions of fruit or vegetables per day?” Never, rarely, sometimes, often, always; “Eating five portions of fruit and vegetables a day is something I do automatically;” “Eating five fruit and vegetables a day is not something I do or plan to do” Strongly disagree – Strongly agree).

4.4.5.2.2 Purchasing behaviour questionnaire.

The same 108 items were used as in the experimental conditions; however the items related to purchasing behaviours over the next four weeks. This included 15 cognition items for each of the six purchasing behaviours and 3 past behaviour questions (purchasing groceries, purchasing toiletries and/or cosmetics, purchasing household cleaning items, reducing clothing purchasing, reducing music purchasing including digital downloads, and reducing spending).

4.4.5.2.3 Dissonance Manipulation.

Participants in the dissonance experimental condition were also exposed to a different instruction page to the other two conditions. This aimed to emphasize the importance of healthy living and how closely behaviour and health are related. See appendix B for the full instructions given to participants in the dissonance condition. Participants in the dissonance condition were also exposed to 12 further items presented after the cognition items but before the past behaviour items. This aimed to enhance participants awareness of their potential feelings of dissonance in relation to completing the questionnaire. Two dissonance items anchored on a seven point Likert scale (Definitely not-Definitely yes) were used that related to each of the six health behaviours (“I gave answers to the survey questions that I thought I should give, rather than what I really believe about...” “The answers that I have given to the survey questions were more positive than my real views about...”).

4.4.5.2.4 Outcome Measures.

All participants were asked about their performance of each of the six health behaviours over the past four weeks. Participants were asked to answer three questions about the six health behaviours (“How often do you eat at least five portions of fruit or

vegetables each day? Never, rarely, sometimes, often, always; “On how many days did you eat 5 portions of fruit and vegetables over the past four weeks?” “Over the past four weeks I ate at least 5 portions of fruit and vegetables per day” Strongly disagree – Strongly agree). Participants were also asked a single intention question relating to each of the six health behaviours, this was identical to one of the intention items from part one of the study (“I intend to eat at least five fruit and vegetables a day over the next four weeks”). The same behaviour and intention items were also asked relating to the six purchasing behaviours.

Based on the previous work by Spangenberg and Sprott (2006) supporting self-monitoring as a moderator of the QBE, where low self-monitors were affected by the QBE but not high self-monitors, self-monitoring was also measured as a potential moderator. Participants were also exposed to a self-monitoring scale, this was the revised version taken from Lennox and Wolfe (1984), comprising of 13 items and used a 5 point Likert scale anchored at 1 (very much like me) to 5 (not at all like me). An overall score of self-monitoring was worked out by adding up items, apart from items 4 and 6 which were reverse coded. Individuals above the mean score were classified as high self-monitors, if participants scored below the mean they were classified as low self-monitors.

4.4.5.3 Procedure

The study was advertised via Prolific Academic. Participants were first asked to complete an informed consent form online and were then randomised and directed to complete one of the six alternative questionnaires. Participants were first asked to complete their demographic details. They were then asked to complete the manipulation questionnaire, the contents of which differed depending on which condition participants were randomised to. After four weeks participants were invited to take part in the follow up questionnaire and were asked to report their levels of the twelve behaviours over the past four weeks. Participants were also asked to report their self-monitoring and conscientiousness (conscientiousness results were non-significant so are not reported here). They were then fully debriefed as to the aims of the experiment and given contact details of who to contact if they had further questions.

4.4.5.4 Analyses

Demographic variables were coded as follows: Gender (Male/Female); Ethnicity (Caucasian/Non Caucasian); Education (Less than University level/University level);

Employment (Employed/ Student/ Not currently working). These variables were then subjected to Chi-square analyses in order to assess successful randomisation. Age was subjected to a one way ANOVA.

A mixed hierarchical MANOVA was conducted with one overarching factor (Condition: Experimental vs. control) and 2 nested levels for the experimental groups (QBE plus dissonance vs. QBE-only) was conducted, with Type of behaviour (protect/risk) as a within subjects factor. In order to explore effects separately in risk and protection behaviours the analyses were repeated within risk behaviours and protect behaviours and including specific behaviour (one of three behaviours) as a within subjects factor. Correlations were performed between intentions and behaviour and between self-reported intentions and dissonance. A mixed MANOVA was conducted to assess the influence of condition on self-reported intentions, with behaviour as the within subjects factor. The MANOVA was repeated with self-monitoring entered instead of condition.

4.4.6 Results

4.4.6.1 Demographics and Randomisation

Randomisation was found to be successful. There were no differences between the three conditions for gender, $\chi^2(6, N = 1935) = 7.09, p = .31$; ethnicity, $\chi^2(6, N = 1935) = 12.61, p = .70$; Employment, $\chi^2(18, N = 1935) = 16.69, p = .55$ or Age, $F(2, 1530) = 1.90, p = .15$. There were significant condition differences for SES Society, $\chi^2(20, N = 1935) = 40.20, p = .005$; SES community, $\chi^2(20, N = 1935) = 56.46, p < .01$ and Education, $\chi^2(12, N = 1935) = 22.85, p = .03$. There were small significant differences between participants who completed baseline only, compared to those who completed follow up measures. Participants at follow up were significantly older ($M = 31.76, SD = 11.16$) than those who completed baseline measures only ($M = 30.36, SD = 10.87$), $F(1, 1955) = 5.24, p = .02$, they were also more likely to be higher education ($N = 897, 58.5\%$) than baseline only participants ($N = 207, 48.8\%$), $\chi^2(1, N = 1958) = 12.59, p < .01$. There were no differences for ethnicity ($p = .44$) or employment status ($p = .06$). In terms of behavioural intention, participants at baseline only had lower intention toward flossing ($p < .01$) and drinking ($p = .02$) compared to follow up participants. There were no intention differences for fruit and vegetable consumption ($p = .06$), physical activity ($p = .62$), sedentary behaviour ($p = .27$) or unhealthy snacking ($p = .18$).

4.4.6.2 Behaviour

The results of the hierarchical mixed MANOVA supported a significant QBE, $F(3, 1528) = 2.83, p = .04$. No nested effect of the two QBE conditions was found, $F(3, 1528) = 1.07, p = .36$. There was however a significant interaction between type of behaviour (protection/risk) and condition (QBE/control), $F(3, 1528) = 5.99, p < .001$. This supported the need for risk and protection behaviours to be analysed separately.

4.4.6.2.1 Risk behaviours

There was a significant main effect of QBE indicating lower frequency of performing risk behaviours in the QBE conditions than the control condition (QBE: $M = -.01, SD = .48$, Control: $M = .04, SD = .51$), $F(1, 1530) = 4.17, p = .04, d = -.11, 95\% CI = -.21, -.003$. There was no behaviour x QBE interaction, $F(2, 3062) = 1.05, p = .35$, suggesting this QBE effect did not vary across type of risk behaviour. There was no significant nested effect of the two QBE conditions $F(1, 1531) = 3.39, p = .07$, those in the dissonance condition reported the lowest frequency of risk behaviours ($M = -.04, SD = .48$) compared to QBE alone condition ($M = .02, SD = .47$) and the control condition ($M = .04, SD = .51$).

4.4.6.2.2 Protection behaviours

There was a significant main effect of QBE indicating greater protection behaviours in the QBE conditions than the control (QBE: $M = .04, SD = .62$, Control: $M = -.08, SD = .63$), $F(1, 1530) = 11.02, p < .001, d = .19, 95\% CI = .09, .30$. There was also a significant effect of the nested levels of the QBE conditions, $F(1, 1531) = 4.22, p = .04$; protection behaviours were performed significantly more frequently by participants in the dissonance condition ($M = -.08, SD = .62$) than participants in the QBE alone condition ($M = -.004, SD = .63, p = .04$) or the control condition ($M = -.08, SD = .62, p < .001$). There was no interaction between protection behaviours and the nested levels of the QBE, $F(2, 3062) = 1.05, p = .35$, supporting an overall increase in protection behaviours as a result of exposure to the QBE + dissonance condition.

Table 4.3. *Demographic Characteristics, and protection and risk DVs for Experimental and Control Conditions.*

Variables ¹	QBE		QBE + dissonance		Control group	
	<i>N</i>	<i>M</i> (or %)	<i>n</i>	<i>M</i> (or %)	<i>N</i>	<i>M</i> (or %)
Age	502	32.55	512	31.31	519	31.44
Gender (%)						
Male	244	48.6	238	46.5	272	52.3
Female	251	50.0	268	52.3	243	46.7
Ethnicity (%)						
Non-Caucasian	130	25.9	149	29.1	152	29.2
Caucasian	372	74.1	363	70.9	368	70.8
Education (%)						
Below undergraduate degree	208	41.4	224	43.8	205	39.4
Undergraduate degree/above	294	58.6	288	56.3	315	60.6
Employment (%)						
Full/Part time employment	328	65.3	324	63.3	338	65.0
Full/Part time student	90	17.9	104	20.3	93	17.9
Not currently working	84	16.7	84	16.4	89	17.1
Risk behaviour		.01 (.47) ^{ab}		-.04 (.48) ^a		.04 (.51) ^b
Protection behaviour		-.003 (.63) ^b		.08 (.63) ^a		-.08 (.62) ^b

¹All demographic differences between conditions were non-significant. ^{ab} where postscripts differ indicates significant condition differences.

4.4.6.3 Dissonance

The average dissonance score was calculated from the two rankings given to each of the behaviours, this score was ranked on a scale between 1-7. Average dissonance for participants in the QBE plus dissonance condition was very low ($M = 2.37$, $SD = 1.77$). Dissonance ratings were similar for all six health behaviours (Fruit and vegetable: $M =$

2.43, $SD = 1.92$; Physical activity $M = 2.41$, $SD = 1.91$; Flossing $M = 2.34$, $SD = 1.81$; Alcohol consumption $M = 2.34$, $SD = 1.80$; Sedentary behaviour $M = 2.33$, $SD = 1.80$; Unhealthy snacking $M = 2.34$, $SD = 1.84$).

In order to assess the influence of reported intention and dissonance on the QBE, correlations were conducted between intentions and dissonance and intentions and behaviour. This supported a small-to-medium positive correlation (Cohen, 1988) between reports of intention toward the six behaviours and levels of the six health behaviours at follow up ($r = .22$, $p < .001$) and levels of dissonance ($r = .22$, $p < .001$) assessed only in the QBE plus dissonance condition. The mixed MANOVA found no interaction between behaviour and condition $F(1, 1292) = .17$, $p = .68$ on intentions, however a significant effect of condition was found $F(1, 1292) = 11.41$, $p < .01$; intentions were found to be greater in the QBE + dissonance condition ($M = 4.75$, $SD = 1.05$) than the regular QBE condition ($M = 4.55$, $SD = 1.07$).

4.4.6.4 Self-monitoring

The MANOVA was then conducted while entering the self-monitoring data. This supported a significant effect of self-monitoring on behaviour, where low self-monitors tended to perform less of the risk behaviours and more of the protection behaviours, $F(48, 1483) = 1.44$, $p < .01$. This was significant for five out of the six behaviours ($p < .05$), with only no self-monitoring effect on alcohol consumption ($p = .15$). No significant QBE x self-monitoring interaction was supported in any of the six behaviours ($p > .05$). This was repeated on the protection and health risk indices, no significant interaction between QBE and condition was found for either the protection ($p = .86$) or risk indices ($p = .39$).

4.5 Discussion

The results of study 4 indicated an overall reduction in health risk behaviours as a result of the QBE manipulation compared to control which supports hypothesis 2. The results also demonstrated an increase in protection behaviours, but this was only as a result of exposure to the QBE + dissonance condition, not exposure to the QBE condition alone; hypothesis 1 was therefore only partly supported. Hypotheses 3a and 3b, that the dissonance manipulation would enhance the QBE, were also partly supported. The dissonance manipulation was found to significantly increase health protection behaviours beyond any effect of the QBE condition alone and while both QBE

conditions were found to significantly reduce the three risk behaviours, this was greater (although not significantly) in the dissonance condition. The results therefore support both the QBE interventions (alone and combined with the dissonance manipulation) influencing multiple health risk behaviours along with the added benefit of this simple dissonance manipulation above and beyond the influence of the standard QBE intervention in protection behaviours. Although when the focus is on either both risk and protect behaviour or on protect behaviours alone only the use of a QBE + dissonance manipulation is supported. The results also demonstrated that intentions were reported to be greater in the QBE + dissonance condition compared to the regular QBE condition and this was found to be significantly related to subsequent performance of the six behaviours.

The present study is the first to find a QBE on multiple health behaviours. In the only previous published study (Lawrence & Ferguson, 2011) only alcohol consumption was reduced as a result of the QBE intervention. The present study found a reduction in the three health risk behaviours, rather than just in alcohol consumption. These differing results could be explained by the different study setting and sample used. The present study was conducted online with a much larger sample size compared to that reported by Lawrence and Ferguson (2011; $N = 267$), while the previous study was conducted during a University lecture and sampled Undergraduate students only. An alternative explanation is that the present study provided recommended levels of behaviour prior to each set of questions, this therefore provided a target level of behaviour and potentially a normative influence that was not provided in the study by Lawrence and Ferguson (2011).

The present study also found no effect of the QBE alone on flossing behaviour despite this producing the greatest effect size in the meta-analysis reported in Chapter 2, there were also no significant effects on physical activity despite the reduction in sedentary behaviour, although previous studies have demonstrated that sedentariness produces its own risk factors independent of physical activity (Thorp, Owen, Neuhaus, & Dunstan, 2011).

The present study has a number of strengths and weaknesses. The present study was conducted in a large and diverse sample of individuals, powered a-priori to detect a QBE based on the review reported in Chapter 2. Participants were followed up over four weeks. The results found small effects on behaviour which overall is consistent with the meta-analysis presented in Chapter 2. The present study is the first to

demonstrate that the QBE can influence multiple behaviours at once, specifically both protection and health risk behaviours. Limitations of the study include the self-reported nature of the follow-up behaviour, along with the non-validated measures of behaviour. Although the three measures of behaviour at follow up were found to be internally consistent and the assessment measures chosen were selected to risk participant burden and to allow a comparable measure of behaviour across the six different health behaviours. An additional limitation in the QBE plus dissonance condition was that participants were not exposed to the dissonance manipulation for a set amount of time due to limitations of the survey software used, it is therefore unclear how long participants were exposed to the manipulation for. However, the results do suggest that despite this limitation, the dissonance manipulation was successful. An additional limitation linked to this was that the design of the study was not a 2x2 between subjects design, therefore it is not clear whether the dissonance manipulation alone and without the QBE questionnaire would have influenced behaviour.

The results of the present study have a number of theoretical and practical implications. In terms of enhancing our knowledge and understanding of the QBE from a theoretical perspective, the present study supports a dissonance manipulation as enhancing the QBE. This supports the dissonance argument outlined in Chapter 1 as being one of the key mechanisms to influence the QBE. Although the present study did not directly compare this against other potential mechanisms, it is the first study to attempt to manipulate dissonance directly, rather than indirectly through a self-affirmation manipulation. This will be discussed further in the general discussion of the present chapter.

It is also the first study to show that questioning multiple health behaviours can produce a change in multiple health behaviours, along with the first QBE study conducted online to show that this could produce a change in both protection and risk behaviours. From a practical perspective, this supports the QBE as a brief intervention to influence protection and health risk behaviours. Further research would benefit from investigating whether reducing the number of target behaviours would produce a greater effect on these behaviours as suggested by Wilson et al. (2015).

4.6 General Discussion

The three studies reported in the present chapter aimed to investigate the QBE in an online setting on a range of health risk behaviours; study four also investigated the

QBE on multiple protection and risk behaviours. Study 2 found no significant effects of asking participants a small number of prediction questions on subsequent performance of a specific health risk behaviour (biscuit consumption), with behaviour followed up over one week follow up. It also found that participants had low levels of self-reported dissonance when thinking about the behaviour, which may contribute to the lack of overall effect produced as a result of questioning. Study 3 also found mainly non-significant effects of asking a mainly young adult population to predict their future social smoking and/or social drinking behaviour. The general pattern in data supported the QBE as increasing smoking behaviour as a result of questioning. However, when accounting for the negative skewness in the data, this supported a significant effect of asking about both social smoking and drinking on the number of days participants reported social drinking compared to when participants were asked about drinking only. Study 3 also found participants had low levels of dissonance when thinking about their smoking and drinking behaviour. Finally, study four found an overall significant reduction in health risk behaviours as a result of a QBE manipulation, it also found a significant increase in protection health behaviours however this was only when the QBE manipulation was combined with a manipulation aiming to increase dissonance. These three online studies therefore show inconsistent findings as to the influence of the QBE over health risk behaviours. While study 4 found a reduction in health risk behaviours, no effects were found on biscuit consumption as targeted in study 2 and study 3 also appears to support a potential increase in health risk behaviours as a result of making behavioural predictions relating to reducing the behaviour. One explanation for this differing findings could be due to the variation in question type used in studies 2 and 3 compared to study 4. Study 4 involved participants being asked over 100 questions relating to their cognitions and past behaviour in relation to the six target behaviours. Although item number was not found to be significant moderator in the meta-analysis presented in Chapter 2, asking a large number of questions may have encouraged more in-depth consideration of participant current behaviour compared to the other two studies, where studies 2 and 3 only asked three prediction questions. Related to this point, the QBE intervention in study 4 included specific recommended levels of behaviour and therefore participants were made aware of the target levels of behaviour, this may have provided a normative influence which directed specific behaviour change. Participant awareness of target levels of behaviour was not tested in studies 2 or 3, nor was their awareness for the potential negative health outcomes

associated with the target behaviours. Providing reference information for participants in study 4 in the form of recommended levels of behaviour, may have provided a direction for participant behaviour change (Gollwitzer & Oettingen, 2008).

Motivation was not explicitly measured in any of the three studies, therefore it is not possible to ascertain whether participants had differing levels of motivation to change the different focal behaviours in the three studies presented here. While the dissonance levels participants reported were low in both studies 2 and 3 and therefore they may not have felt sufficient motivation to change their behaviour, the dissonance measure used had not been previously validated. Study 4 found a reduction in health risk behaviours as a result of QBE questioning alone and when combined with a dissonance manipulation, however the levels of dissonance reported were also low in this study, although a different measure was used to that in studies 2 and 3.

Study 4 in the present chapter supports the QBE influencing both risk and protection health behaviours, although this was only supported when combined with a further manipulation focusing on dissonance in the latter. This was despite the sense of anonymity and reduced social desirability of responses that are associated with conducting research online. The three studies also support the influence of dissonance over the QBE, particularly when conducted in an online setting. Study 4 demonstrates that the QBE, when combined with a dissonance manipulation, can be used to produce a change in both protection and health risk behaviours. Future QBE studies would benefit from targeting individuals that have high motivation to change their behaviour and/or could include a measure of motivation to change. Further research would also benefit from investigating the potential influence of a dissonance manipulation over the QBE in these behaviours, where a 2x2 design would be beneficial to tease apart the potential effects of the QBE from the dissonance manipulation alone. All of the points raised in the present section will be discussed further in Chapter 6.

Chapter 5 Investigating the QBE in three lab based studies of healthy and unhealthy snacking.

5.1 Introduction

As discussed in Chapter 1, a number of authors (e.g., Fyzsimons & Moore, 2008; Moore & Fitzsimons, 2008; Sherman, 2008) have suggested that applying the QBE to health risk behaviours is likely to be detrimental to health. They suggest that there is some potential for the QBE to increase these behaviours rather than reduce them. While this doesn't appear to have been supported in the meta-analysis presented in Chapter 2, the majority of studies on unhealthy behaviours included in this meta-analysis were in the assessment reactivity literature ($k = 11/16$). These studies therefore investigated the influence of measuring behaviour on subsequent behaviour within a mixture of patient and student samples. Chapter 2 also showed that in general studies in the assessment reactivity literature produced no significant effect on behaviour. The studies reported in Chapters 3 and 4 also do not consistently support the suggestion that the QBE can increase health risk behaviours. The present chapter aims to investigate this further using a lab setting. Lab studies of the QBE were supported as producing the greatest QBE in Chapter 2 and are therefore most likely to produce a change in behaviour. This setting is also the most appropriate setting to manipulate specific factors relating to the specific questions asked, along with potentially providing better understanding potential mechanisms underlying the QBE. Three lab studies and a meta-analysis of their findings are presented. They aim to manipulate question wording in relation to healthy and unhealthy snacking, also investigating the influence of questions framed as 'doing' or 'not doing' behaviour. Attitude accessibility is also investigated as a mechanism of the QBE.

There are a number of potential explanations for the QBE producing greater effects within a lab setting compared to other study settings. First, QBE studies based in the lab are under a greater level of control by the experimenter. Answering the questions is likely to be the key focus of the participant, rather than having potential exposure to a range of other distractions which is an issue with online studies, as previously discussed in Chapter 4. This would suggest that the individual may apply a greater level

of cognitive resources to process the questions than they would otherwise when answering the questions in a home or field setting, or online.

Second, lab studies of the QBE are more likely to guarantee participant exposure to the QBE intervention. Field based studies, particularly those that involve individuals being mailed questionnaires, do not have this guarantee. Instead it is difficult to assess whether individuals have been exposed to the intervention or not, where knowledge of this relies on the individual not only completing the questionnaire but also then mailing this back and this is likely to involve a certain level of motivation toward the behaviour in question. Mankarious and Kothe (2015) have argued that any subsequent change in behaviour attributed to the QBE may be linked to self-selection bias. The present studies aim to overcome this by not specifically informing participants which focal behaviours will be tested in order to reduce the likelihood of participants self-selecting to complete the studies due to a motivation to change their snacking behaviour.

A third and final suggestion for the QBE producing larger effects in lab settings may be due to demand effects. The level of involvement by the experimenter and the reduced sense of anonymity that occurs in lab studies are likely to encourage more socially desirable responding and therefore increase the chance of a QBE. This is particularly the case if the QBE is at least partly due to the over-prediction of socially desirable responses that Sherman (1980) suggested in his seminal paper of the effect. In relation to unhealthy or health risk behaviours, these demand effects would be assumed to produce a reduction in these behaviours, whereby participants would be expected to under-predict their performance of behaviour or understate their intentions toward future behaviour performance.

The three studies reported in the present chapter will manipulate the specific wording of the QBE questions along with the specific focal behaviour. Despite the lack of effect reported in study 2 when comparing the different framing of questions relating to a specific snacking behaviour, the lab setting used in the present studies may be a more appropriate setting to manipulate specific question wording. Due to the low power often produced in QBE studies, particularly in the lab, three studies are reported along with a meta-analysis of their combined findings. These collectively aim to investigate question wording and the QBE on protection and risk versions of the same health behaviours: healthy and unhealthy snacking. There are a number of benefits to investigating protection and risk versions of the same behaviour in the same study. This is likely to produce a reduction in potential confounding variables, so any effect

produced is likely to be due to the manipulation. It also provides a comparison of the same intervention on different behaviours to allow a more direct comparison than if multiple studies are conducted on the same behaviours.

5.1.1 Lab studies in health behaviours

To date there have been few lab studies of the QBE on health risk behaviours. In one such study Williams, Block, and Fitzsimons (2006) also compared a healthy behaviour (exercising) against an unhealthy behaviour (illegal drug use). Whilst this study reported an increase in both these behaviours after participants were asked about likelihood of performing behaviour over the next two months, subsequent re-analysis of the data (Schneider, Tahk, & Krosnick, 2007) found that the data were skewed due to the low proportion of participants who performed either behaviour, and that when data were re-analysed there was no difference between experimental and control conditions for either behaviour.

5.1.2 ‘Doing’ vs. ‘Not Doing’

Investigating the QBE in both protection and health risk behaviours in the same set of studies may influence the direction of effect produced by questioning. As previously mentioned in Chapter 4 (study 2), one further potential factor that may influence the direction of the QBE is the question framing: specifically whether the question relates to performing (doing) or not performing (not doing) the behaviour. Outside of the QBE literature, it has been proposed that doing vs. not doing behaviours require different goal states and different factors that influence activation of these states (Richetin, Conner, & Perugini, 2011). A number of studies by Richetin et al. (2012) supported this premise where they promoted the finding that having intentions, in this case to not reducing resource consumption, was not the same as having a low intention to reduce resource consumption. A further study by Adriannse (2011) found that when individuals formed implementation intentions related to ‘not doing’ a behaviour, this instead increased activation in relation to performing the behaviour which was subsequently associated with greater performance of an unhealthy behaviour.

Levav and Fitzsimons (2006) provided the only published study to date in the QBE literature that manipulated question wording to focus on intentions toward ‘doing’ vs. ‘not doing’ where they also assessed intentions to ‘avoid’ fatty foods. They found no difference between the negation (not do behaviour) and intention (to do behaviour) conditions, where both reduced the proportion of participants who chose a fatty snack

in a food choice task. They also found that participants in a third condition (avoidant: likelihood of avoiding consuming fatty food) reduced fatty snack choice more than the other two conditions. Further evidence is required to assess the impact of question framing on the QBE, particularly when investigating this applied to risky behaviour and comparing this to non-risky alternatives of behaviour.

5.1.3 Attitude Accessibility

Attitude accessibility has been suggested as one of the key mechanisms underlying the suggested increase in risk behaviours (Fitzsimons & Moore, 2008). They suggest that individuals, particularly adolescents, are more likely to hold ambivalent or positive implicit attitudes toward risk behaviours. Answering questions therefore activates an individual's positive attitude relating to the focal behaviour and then increases the likelihood that they perform in accordance with this attitude, thereby increasing risk behaviours.

While a recent meta-analysis by Wood et al. (2016) provided little support for the influence of attitude accessibility over the QBE, a recent study investigating the QBE in healthy snacking found attitude accessibility mediated the effect of questioning on behaviour (Wood et al., 2014). Participants were asked to report their intentions toward eating healthily in the next week and had the accessibility of their attitudes toward healthy food words assessed using a reaction time task. Attitude accessibility was found to mediate the relationship between the intention measure and healthy snack choice, where participants in the intention condition responded more quickly to healthy snack words compared to control condition. To date, as far as we are aware, there has not been a study to test the mediating role of attitude accessibility in health risk behaviours. Attitude accessibility is measured in the present three studies to assess whether attitude accessibility mediates the question-behaviour effect when it is applied to both healthy and unhealthy behaviours. It is worthwhile investigating the potential mechanisms underlying the QBE. This would be particularly useful in applying the QBE to health risk behaviours in order to assess whether any attitude accessibility effects are in the opposite direction to that previously shown in studies relating to healthy behaviours (e.g., Wood et al., 2014).

5.1.4 Snacking behaviour

Snacking was selected as the focal behaviour in the three studies reported in this chapter. Previous studies supported an increase in healthy snacking (Wood et al., 2014)

and a reduction in unhealthy snack choice (Levav & Fitzsimons, 2006), although this was not supported in studies 2 or 4 presented in Chapter 4. However, previous studies have not compared the effects of questioning on both healthy and unhealthy snacking in the same set of studies. Rather than the specific snacking behaviour focused on in study 2, the present three studies will relate to general unhealthy snacking. Additionally, unhealthy snacking is a behaviour that can be measured easily both within a lab environment and outside of it. It can provide the potential for both an objective behavioural choice task as well as allowing assessment over a longer follow up using self-report. This allows an investigation of the influence of the QBE on a short term objective measure as well as a longer term subjective measure of behaviour. It also provides a behaviour where both healthy and unhealthy versions of the same behaviour can be assessed using the same measures, which should reduce the influence of potential confounders that may influence the QBE.

5.1.5 Aims

Three studies are reported examining the QBE in healthy (study 5), unhealthy (study 7), and both healthy and unhealthy snacking (study 6). With snacking defined as the consumption of foods between main meals. There are a number of ways in which the three studies extend the literature. First, as outlined in study 4 presented in Chapter 4, few studies have examined the QBE in protection and health risk behaviours within the same study. The studies investigated the QBE on both healthy (protection) and unhealthy (risk) snacking in order to provide a direct comparison of QBE effects on both of these whilst reducing the influence of potential confounds. Both healthy and unhealthy behaviour were assessed using both self-report and objective measures. Second, the studies also extend the 'doing' and 'not doing' intention work by applying this within a QBE study context. Third, these studies are the first to examine the mediating role of attitude accessibility for the QBE on health risk behaviours. Fourth, despite the lack of support as a moderator in study 4, based on previous work by Spangenberg and Sprott (2006) supporting self-monitoring as a moderator of the QBE, where low self-monitors were affected by the QBE but not high self-monitors, self-monitoring was also measured as a potential moderator (in studies 6 and 7 only). Fifth, and finally (in study 7 only) public commitment was manipulated to assess the influence of this on the QBE as a previously untested potential mechanism, as this was not found to be influential it is not focused on in this study. Finally, given reviews have suggested the QBE to represent a small effect (Rodrigues et al., 2015; Wood et al.,

2016), a meta-analysis and mega-analysis of the three studies are also reported to overcome issues relating to insufficient power, a technique that has not previously been employed in QBE studies.

5.1.5.1 Hypotheses

- 1) Questions related to ‘doing’ behaviour would produce a significant increase in behaviour regardless of whether behaviour is healthy or unhealthy.
- 2) Questions related to ‘not doing’ behaviour would produce a significant decrease in behaviour regardless of whether behaviour is healthy or unhealthy.
- 3) Attitude accessibility will mediate the effect of questions on behaviour. Questioning will lead to more accessible attitudes and thus more behaviour, regardless of whether behaviour is healthy or unhealthy.

5.2 Shared Methods

Due to the similarity of methods between the three studies, these will be reported altogether. First the shared methods will be reported, followed by the unique aspects of each study. Results from the three studies will be reported for each of the dependent variables. The results of the meta and mega analyses of the combined studies will then be reported in section 5.6.

5.2.1 Participants

A priori sample size calculations were calculated using based on the effect size for a study conducted by Wood et al. (2014; $g = .35$) which investigated the QBE in healthy snacking, the design of the Wood et al. study is similar to the three studies presently reported. Based on an alpha levels of $<.05$ to provide 80% power this would require 285 participants to detect differences between conditions in each of the three studies. However, the aims of the present studies were exploratory and so each individual study was not powered sufficiently, instead sample sizes were selected based on previous lab studies of the QBE investigating snacking behaviour (e.g., Levav & Fitzsimons, 2006 study 2, $n = 24$ in three experimental conditions, control $n = 24$; Williams, Fitzsimons, & Block 2004, study 1 $n = 38$ in individual experimental conditions, total experimental $n = 114$; Wood et al., 2014: experimental $n = 41$, control $n = 84$).

For all three studies, staff and students were recruited from a University in the north of England. In study 5, there were 129 participants (71 men and 58 women; mean age = 23.18 years; $SD = 4.43$ years). In study 6, there were 73 staff and students (8 men and 65 women; mean age = 23.47 years, $SD = .98$ years). Of these, 60 participants returned the snack diary and therefore provided full data for analysis. Participants were a mixture of students and staff from a University in the North of England who volunteered to take part in a study they were told was to investigate judgements, advertised via emails sent to a participant pool database of interested volunteers. Participants were offered a £5 voucher for taking part. 60 participants returned the snack diary and therefore provided full data for analysis. In study 7, 100 participants were recruited (10 men and 90 women; mean age = 25.79 years, $SD = 10.50$ years).

5.2.2 Design

All three studies were approved by the School Ethical Review Board prior to data collection. In each study, all participants were randomised to condition prior to entering the lab using a random number generator. Participants were blinded to condition. In studies 5 and 6, participants were randomised to one of two experimental conditions (study 5: Healthy; Healthy Negation; study 6: Healthy; Unhealthy Negation) or a control group. In study 7, an extra condition was added such that participants were randomised to either regular QBE, QBE manipulating high public commitment, or QBE manipulating low public commitment. This was justified as public commitment has been supporting to be potentially influential over behaviour (Pratt et al., 2015; Cialdini, 2009). The control group in all three studies completed measures relating to their intentions to do an unrelated behaviour (use the internet). These three studies were approved by the University of Leeds, School of Psychology Ethics Committee (ref: 11-0128, 14-0043, 14-0102).

5.2.3 Procedure

Participants were invited into the lab to take part in a study aiming to investigate the different factors influencing judgements; they were paid £5 or module credits for taking part. Participants first completed the informed consent form and were asked to complete demographic variables on the computer, including age, gender and occupation. They were then given the questionnaire to complete on a computer. The wording of this questionnaire differed dependent on condition. Participants then completed an attitude accessibility task and then the Stroop colour naming task was

used as a filler task before the objective food task. After this, participants were asked to complete a daily snack diary and to return it one week later. Participants in studies 6 and 7 were emailed this after one week and were asked to complete the questionnaire retrospectively.

5.2.4 Measures

5.2.4.1 Attitude Accessibility.

The attitude accessibility task, delivered using E-Prime Version 1.2 (Schneider, Eschman, & Zuccolotto, 2002), was the same as that used in Wood et al. (2014). Participants were shown 10 practice words followed by 160 non practice trials. These included 30 target food related items, (10 healthy e.g., APPLE, BANANA; 10 unhealthy e.g., CREAM, CAKE, and 10 neutral food e.g., BEEF, EGGS), along with 130 filler items not related to food (e.g., BEES, CARS, LORRY). Participants were asked to rate the target word as either “good” or “bad” by pressing specified keys (m and z; counterbalanced for each participant). Target words remained on screen until a response was made followed by an inter-trial interval of 1 second. Responses and response latencies were recorded in milliseconds. The food words had been piloted previously by Wood et al. (2014) where the healthiness of food words were rated by 22 participants who rated the words on a seven point scale of healthiness (very unhealthy – very healthy). Neutral words were those that were rated around the midpoint of the scale. The task had been designed and used by Wood et al. (2014), however it has not been previously validated.

5.2.4.2 Stroop colour naming task.

Participants were presented with (40) words one by one (10 practice followed by 30 non practice words), they were asked to press the letter “M” if the word was presented in yellow or blue ink or “Z” if the word was in red or green ink.

5.2.4.3 Objective food choice.

Participants were told after the Stroop task was completed that the experiment was finished and were offered one item of either fruit or chocolate from two bowls placed in a separate room to the experiment on their way out of the laboratory. They were informed that this was to thank them for their participation. The experimenter was not present in the room while the participant made their selection. The number and range of chocolate and fruit available was the same for all participants. The participant selection

was recorded and used as an objective measure of behaviour. This variable was coded as -1, 0, or +1 depending on whether participants chose an unhealthy snack, neither/both or a healthy snack respectively.

5.2.4.4 Snack diary.

In Study 5, participants were given an 8 day snack diary to fill in each day over the week following the lab session. The diary prompted participants to state the number and exact snacks that were eaten at three time points during each day (before lunch, after lunch and after dinner). One week after the lab experiment, participants were invited back into the lab and asked to total up the number of healthy and unhealthy snacks consumed over each day of the week. In order to reduce effects of self-monitoring of food consumption over the week following the lab portion of the study, participants in studies 6 and 7 were emailed a 7 day retrospective snack diary one week after they completed the lab-based experiment. Otherwise the measure was identical to the snack diary provided in study 5. The total number of healthy and unhealthy snacks was calculated in the same way as it was in study 2. Each snack was coded as either healthy or unhealthy based on whether it was high in sugar/fat (e.g., cakes, biscuits, crisps) or low in sugar/fat (e.g., fruit, yoghurt, rice cakes). A proportion score was then calculated (total healthy snacks plus unhealthy snacks/ total healthy snacks).

5.3 Methods

5.3.1 Manipulations

All three studies used manipulations that included extra items in questionnaires. These items were scored on a Likert scale from 1-7. Intention items were anchored at 1 (Strongly disagree) to 7 (Strongly agree). Attitude items were anchored dependent on the specific attitude constructs they measured.

5.3.1.1 Study 5

Healthy Condition. Participants in this condition were asked to complete seven items that assessed intentions and attitudes to eat healthy snacks in the next few weeks. Three items measured intentions to eating healthy snacks in the next week ('My intention to eat healthy snacks in the next few weeks is...' Strongly agree-Strongly Disagree). Four items assessed attitudes to eating healthy snacks in the next few weeks

(‘For me eating healthy snacks in the next week would be...’ Beneficial-Harmful, Enjoyable-Unenjoyable, Good-Bad, Worthwhile- Not worthwhile).

Healthy Negation Condition. Participants in this condition were asked to complete an equivalent set of items to those in the ‘Healthy Intention Condition’ but the focus of the seven intention and attitude items related to *not* eating healthy snacks in the next week (e.g., ‘My intention to not eat healthy snacks in the next few weeks is...’ Very strong-Very weak).

Control Condition. The questionnaire completed by participants in the control condition was identical to the questionnaires completed by those in the two experimental conditions with one key difference: the questions focused on intentions and attitudes toward using the internet in the next few weeks (e.g., ‘I will use the internet in the next few weeks’ Strongly Agree- Strongly Disagree).

5.3.1.2 Study 6

Healthy Condition. For participants in this condition, nine items assessed intentions and attitudes to eat healthy snacks in the next week. The same four items from Study 1 were used to assess attitudes to eating healthy snacks in the next week. Five items were used to assess intentions to eating healthy snacks in the next week (I expect/I will try to/ I predict I will/ I will try to/ My intention to eat healthy snacks in the next week...).

Unhealthy Negation Condition. For participants in this condition, the questionnaire was identical to the questionnaire completed by those randomised to the Healthy Condition but all nine intention and attitude questions related to *not* eating *unhealthy* snacks in the next week (I expect/I will try to/ I predict I will/ I will try to/ My intention not to eat unhealthy snacks in the next week...).

Control Condition. The questionnaire completed by participants in this condition was identical to the questionnaires completed by those in the experimental conditions but instead related to using the internet in the next week (e.g., I will try to/ I predict I will/ I will try to/ My intention to use the internet in the next week...).

Self-monitoring questionnaire

The self-monitoring scale used was the revised version taken from Lennox and Wolfe (1984), comprised 13 items and used a 5 point Likert scale anchored at 1 (very much like me) to 5 (not at all like me). An overall score of self-monitoring was worked out by adding up items, apart from items 4 and 6 which were reverse coded. Individuals

above the mean score were classified as high self-monitors, if participants scored below the mean they were classified as low self-monitors. This was completed by participants in studies 6 and 7 after completing the manipulation questionnaire.

5.3.1.3 Study 7

Unhealthy Negation Condition. This questionnaire completed by participants in this condition was identical to that use by the equivalent group in Study 6.

Control Condition. This questionnaire was identical to the control condition completed in study 6.

Unhealthy Negation + Low Public Commitment Condition & Unhealthy Negation + High Public Commitment Condition. After completing the questionnaire completed by those in the *Unhealthy Negation Condition*, participants in both the low and high public commitment conditions received an error message on the computer screen that stated there had been a system error. The experimenter then searched for the corresponding data file ostensibly in order to assess whether their data had been saved or not. Participants in the low public commitment condition were shown a data file where the responses columns were empty and were then told that their data had not been saved; they were also told that they could not be asked to complete the same task again but instead to move on with the next task. The next part of the experiment was then presented on screen and participants were left to complete it alone. In the high public commitment condition the participant's data file was opened and the experimenter went through each question and read out each of their responses to check whether this was the correct data file.

5.4 Analyses

Each study was analysed individually to assess the effect of condition on the subjective and objective measures of behaviour and the potential mediating effect of attitude accessibility. Success of randomisation was examined using ANOVA. The effects of the manipulation on behaviour and attitude accessibility were assessed using separate hierarchical ANOVAs with one factor (Condition: experimental vs. control) and 2 nested levels for the experimental group (three nested levels for study 7). Studies were then combined and the influence of questioning focusing on healthy behaviour was compared against those focusing on unhealthy behaviour. This was conducted to reduce potential issues associated with limited power of studies that is often common in this

research area (Cohn & Becker, 2003). Finally, the results from all three studies were entered into a single dataset and the same analyses were conducted in the form of a mega-analysis (Sung et al., 2014). This mega analysis was conducted without the separation of studies into healthy and unhealthy focused questioning that was part of the meta-analysis, in order to allow all conditions and all studies to be analysed simultaneously.

5.5 Results

5.5.1 Randomisation checks

Randomisation was successful for each study. In study 5, There were no differences between any of the three conditions for age, $F(2, 126) = 1.41, p = .25$, gender $\chi^2(2, N = 129) = .83, p = .66$ or occupation $\chi^2(4, N = 129) = .87, p = .93$. In study 6, there were no significant differences between conditions for either age $F(2, 70) = .42, p = .66$ or gender $\chi^2(2, N = 73) = 1.96, p = .38$. For study 7, there were no significant differences between conditions for age $F(3, 96) = 1.15, p = .33$, gender $\chi^2(3, N = 100) = 5.20, p = .16$, or occupation $\chi^2(3, N = 96) = 3.00, p = .22$. Each study was analysed for skewness in the dependent variable data. Data was found not to be skewed in any of the three studies (max. skewness value across studies: Food choice: $z = 1.95$, Proportion healthy snacks: $z = .65$).

5.5.2 Objective food choice

Table 5.1 shows descriptive statistics for each of the conditions in the three studies for the three key dependent variables. Across all three studies, participants in conditions using questions that related to unhealthy snacking tended to choose an unhealthy snack compared to when they were asked about healthy snacking. However, the differences between conditions were only significant in study 6 and were otherwise not significant.

In study 5, the difference between experimental (healthy and healthy negation) and control conditions was not significant, $F(1, 126) = 2.88, p = .09$. There was also no effect of the nested levels of the experimental condition, $F(1, 126) = .30, p = .58$.

In Study 6, there was no significant difference between the two experimental (healthy condition, unhealthy negation) conditions compared against the control group, $F(1, 70) = .14, p = .71$. However there was a significant effect of the nested experimental levels, $F(1, 70) = 6.70, p = .01, d = .76$. When comparing the three conditions against each

other the unhealthy negation condition was found to be most likely to choose chocolate ($M = -.63, SD = .77$) and the healthy condition were found to be least likely to choose chocolate ($M = .04, SD = .98$) this difference was found to be significant ($p = .01$). The difference between healthy QBE and control ($M = -.21, SD = .18$) was found to be non-significant ($p = .38$).

In Study 7, there were no significant differences between the control group and the experimental (Unhealthy Negation + Low Public Commitment Condition & Unhealthy Negation + High Public Commitment) conditions, $F(1, 96) = 2.70, p = .10$, and there were no differences between the three experimental conditions, $F(2, 96) = .11, p = .89$, the public commitment manipulation therefore was not successful.

5.5.3 Snack diary

The proportion of healthy snacks consumed over the week was calculated by totalling the number of healthy snacks divided by total number of overall snacks consumed. The results across the three studies supported a higher proportion of healthy snacks being consumed in participants in conditions that asked about healthy snacking, conversely a lower proportion of snacks tended to be consumed by participants asked about unhealthy snacking.

In study 5, there was an effect of condition on the proportion of healthy snacks consumed with significantly more healthy snacks consumed in the two experimental groups (healthy condition, healthy negation; $M = .54, SD = .24$) compared to control group ($M = .44, SD = .25$), $F(1, 124) = 4.47, p = .04, d = .41$. However, there was no effect of the nested levels of the experimental condition, $F(1, 124) = .03, p = .87$.

In study 6, there was no effect of the condition for the proportion of healthy snacks consumed over the week following the study, $F(1, 59) = .03, p = .86$. The control group consumed a slightly smaller proportion of healthy snacks ($M = .41, SD = .22$) compared to the experimental (healthy condition, unhealthy negation) conditions ($M = .42, SD = .18$). There was no effect of the nested levels of the experimental condition, $F(1, 59) = .84, p = .36$.

In Study 7, there was an overall effect of condition, $F(1, 89) = 4.06, p = .04, d = .48$. The control group were found to consume the highest proportion of healthy snacks ($M = .51, SD = .24$) compared to the experimental conditions (Unhealthy Negation + Low Public Commitment Condition & Unhealthy Negation + High Public Commitment

Condition) ($M = .39$, $SD = .26$). There was no effect of the nested levels of the experimental condition, $F(2, 89) = .30$, $p = .74$.

Table 5.1. Means (SD) of outcome variables for conditions within studies 5-7.

Study	Condition	Outcome			
		Objective food choice <i>M (SD)</i>	Snack diary ₁ <i>M (SD)</i>	Attitude accessibility <i>M (SD)</i>	Intention <i>M (SD)</i>
Study 5	Healthy Condition	.07 (.88) ^a	.53 (.25) ^a	-38.20 (203.93) _a	5.51 (1.35) ^a
	Healthy Negation	.17 (.92) ^a	.54 (.23) ^a	-50.52 (140.61) _a	3.10 (1.38) ^a
	Control	-.17 (.88) ^a	.44 (.25) ^b	58.19 (139.56) _b	
Study 6	Healthy Condition	.04 (.98) ^a	.45 (.16) ^a	1.48 (326.94) ^a	5.41 (1.28) ^a
	Unhealthy Negation	-.63 (.77) ^b	.40 (.21) ^a	3.55 (142.13) ^a	3.5 (1.48) ^a
	Control	-.21 (.93) ^{ab}	.41 (.22) ^a	32.60 (122.72) ^a	
Study 7	Unhealthy Negation	-.40 (.87) ^a	.38 (.22) _a	-40.49 (124.30) ^a	3.71 (.28) ^a
	Unhealthy Negation + Low Commitment	-.28 (.98) ^a	.37 (.31) _a	37.67 (152.40) ^a	3.78 (.28) ^a
	Unhealthy Negation + High Commitment	-.38 (.92) ^a	.43 (.25) _a	22.57 (199.96) ^a	3.74 (.32) ^a
	Control	.00 (.98) ^a	.51 (.24) _b	23.14 (113.22) ^a	

^{ab} Indicates where scores not sharing a postscript are significantly different; ₁ Indicates proportion of healthy snacks as calculated from the snack diary

5.5.4 Total snacks consumed

A hierarchical ANOVA with one factor (condition: control vs. experimental) and 2 nested levels for the experimental group was conducted on the total number of snacks consumed over the week following the manipulation. No effects of condition were found in any of the three studies.

In study 5, the most snacks were consumed in the control condition ($M = 17.73$, $SD = 7.18$), followed by the healthy negation ($M = 16.73$, $SD = 8.56$) and healthy intention conditions ($M = 16.57$, $SD = 8.13$), $F(1, 124) = .07$, $p = .79$. There was also no significant effect of the nested levels in the experimental condition, $F(1, 124) = .45$, $p = .50$.

In study 6, the unhealthy QBE condition consumed the most snacks overall ($M = 16.90$, $SD = 5.60$) followed by the healthy QBE condition ($M = 14.88$, $SD = 7.23$), the control group consumed the fewest snacks overall ($M = 15.41$, $SD = 7.80$), the differences between these conditions was found to be non-significant, $F(1, 60) = .06$, $p = .81$. There was also no effect of the nested levels of the experimental condition, $F(1, 60) = .98$, $p = .33$.

In study 7 there was no effect of condition on the number of overall snacks consumed in total over the week. The highest number of snacks were consumed in the control group ($M = 16.6$, $SD = 6.19$), followed by the unhealthy negation condition ($M = 15.60$, $SD = 5.38$) and the high public commitment condition ($M = 13.71$, $SD = 5.73$) the least snacks were consumed by the low public commitment condition ($M = 13.5$, $SD = 5.45$). There were no significant difference between conditions, $F(3, 89) = 1.61$, $p = .19$.

5.5.5 Attitude accessibility

A difference score was calculated to show accessibility of healthy food attitudes relative to unhealthy food attitudes. A low score on the healthy and unhealthy food reaction times was indicative of a more accessible healthy food attitude. The overall influence of attitude accessibility in each of the individual studies is presented in Table 3. The results across the three studies did not show a consistent influence of condition on the attitude accessibility data, or a clear correlation between attitude accessibility and behaviour.

In Study 5, there was a significant effect of condition on attitude accessibility, $F(1, 120) = 10.55$, $p = .002$, with no effect of the nested levels of experimental condition,

$F(1, 123) = 0.36, p = .55$. Consistent with predictions, participants in the healthy snacking intentions conditions had a lower attitude accessibility score ($M = -44.36, SD = 174.18$) indicative of more accessible healthy food attitudes, relative to participants in the control conditions ($M = 58.19, SD = 139.56$).

For study 6, there was no difference between the experimental (healthy condition, unhealthy negation) and control groups for the attitude accessibility difference score, $F(1, 66) = .15, p = .70$. There was also no effect of the nested levels of the experimental condition, $F(1, 66) = .13, p = .72$. Similarly, in study 7, there was no difference between the experimental (Unhealthy Negation + Low Public Commitment Condition & Unhealthy Negation + High Public Commitment Condition) and control conditions on the attitude accessibility difference score, $F(1, 96) = .02, p = .89$ and there was no significant differences between the three experimental conditions, $F(2, 96) = 1.16, p = .36$.

In study 5, attitude accessibility was unrelated to food choice on the objective measure, $r(126) = -.07, p = .44$, and the proportion of healthy snacks consumed, $r(126) = -.13, p = .15$. For Study 6, attitude accessibility had a significant association with behaviour choice, $r(73) = -.26, p = .03$, which suggests that a more accessible attitude to healthy foods was associated with a choosing a healthy snack in the food choice task. Attitude accessibility was not associated with proportion of healthy snacks consumed, $r(96) = -.001, p = .99$. In study 7, attitude accessibility was unrelated to food choice on the objective measure, $r(96) = -.16, p = .12$, and the proportion of healthy snacks consumed, $r(96) = -.10, p = .33$.

5.5.6 Self-monitoring

Despite the issues with splitting psychological variables, the measure of self-monitoring was exposed to a median split where participants were categorised as either high or low self-monitors. An independent samples t-test was then carried out looking at the effect of self-monitoring on behaviour choice and the proportion of healthy snacks consumed. Overall in both studies 6 and 7 there was no effect of self-monitoring on behaviour, there was also no interaction found between condition and self-monitoring.

In study 6 no effect of self-monitoring was found on behaviour choice, $F(2, 67) = .20, p = .65$, and no interaction was found between condition and self-monitoring, $F(2, 67) = .18, p = .83$. Also no effect of self-monitoring was found on the proportion of healthy

snacks consumed, $F(1, 56) = .006, p = .93$, and no interaction was found between condition and self-monitoring, $F(1, 56) = .517, p = .59$.

5.6 Meta-analysis

Due to the mix of study conditions and the varying focus of questions between healthy and unhealthy behaviours, the overall picture of the impact of the QBE on healthy and unhealthy snacking is not entirely clear. Table 5.2 provides a summary of the combined effect sizes (Hedges g and 95% Confidence Intervals) for healthy and unhealthy snacking, reported for each outcome type individually and then a combined average effect size for both outcomes.

Due to the key findings suggesting no difference between ‘doing’ and ‘not doing’ intentions, and a key influential factor being the specific focal behaviour in the question, conditions were separated as follows: *Healthy snacking meta-analysis*: This meta-analysis tested the effect of measuring attitudes and intentions to healthy snacking, regardless of whether or not healthy snacking was assessed in a negation format or not, and comprised two comparisons: From Study 5 both experimental conditions (Healthy Condition + Healthy Negation Condition) were combined and compared against the control group. From Study 6, the Healthy Condition was compared against the Unhealthy Negation Condition and the Control Condition combined. *Unhealthy snacking meta-analysis*: This meta-analysis tested the effect of measuring attitudes and intentions to unhealthy snacking, regardless of whether or not unhealthy snacking was assessed in a negation format or not, and comprised two comparisons. From study 6, the Unhealthy Negation Condition was compared against the Healthy Condition and the Control Condition combined. From study 7, all three Unhealthy Negation Conditions were combined and compared against the Control Condition.

Table 5.2. *Meta-analysis of study results across dependent variable and snacking type*

Comparison groups	Outcome			
	Objective food Choice	Snack diary ^a	Combined DV	Attitude accessibility
	<i>g</i> [95% CI]	<i>g</i> [95% CI]	<i>g</i> [95% CI]	<i>g</i> [95% CI]
Healthy: Study 5 (Experimental vs. control). Study 6 (Healthy condition vs. Unhealthy Negation plus Control)	.41 [-.03, .85]	.33 [.04, .63]	.35 [.15, .56]	-.22 [-.51, .06]
Unhealthy: Study 7 (Experimental vs. Control). Study 6 (unhealthy negation vs. healthy condition plus control)	-.45 [-.78, -.12]	-.35 [-.69, -.002]	-.40 [-.63, -.16]	-.15 [-.45, .04]

^a Proportion of healthy snacks consumed, calculated from the snack diary.

5.6.1 Condition effect on behaviour

As Table 5.2 shows, the overall effect size for healthy questioning is positive for each of the dependent variables and significant for the subjective DV, $g = .33$, 95% CI [.04, .63] and the average of the two DVs combined, $g = .36$, 95% CI [.15, .56] whereas the overall unhealthy questioning is significant and negative for each of the dependent variables: Objective: $g = -.48$, 95% CI [-.80, -.15]; Subjective, $g = -.35$, 95% CI [-.69, -.002]; Combined, $g = -.41$, 95% CI [-.65, -.18]. Due to the coding of dependent variables this suggests that whilst asking about attitudes and intentions toward healthy snacking acts to increase healthy snacking, asking about attitudes and intentions toward unhealthy snacking increases unhealthy snacking. Based on Cohen's d effect size interpretation (.2 Small; .5 Medium; .8 Large) this suggests that the QBE has a small to medium effect on overall snacking behaviour.

5.6.2 Condition effect on attitude accessibility

There was no significant effect of measuring attitudes and intentions towards healthy snacking on attitude accessibility, $g = -.22$, 95% CI [-.51, .06] or of measuring attitudes and intentions towards unhealthy snacking, $g = -.15$, 95% CI [-.45, .04].

5.6.3 Attitude accessibility effect on snacking behaviour

Table 5.3 shows the meta-analysis results for the three studies for attitude accessibility effects on the two measures of snacking behaviour. Whilst only Study 2 from the individual study results found a significant correlation between attitude accessibility and food choice, the meta-analysis shows an overall significant negative effect of attitude accessibility on the food choice score, $g = -.29$, 95% CI [-.52, -.06]. Based on the coding of both variables where a lower attitude accessibility score indicated more accessible attitudes to healthy snacking and a higher food choice score represented choosing a healthy snack, this association suggests that overall more accessible attitudes toward healthy foods were associated with choosing a healthy snack. No influence of attitude accessibility was found for the proportion of healthy snacks consumed, $g = -.18$, 95% CI [-.41, .05].

Table 5.3. Correlations between attitude accessibility measures and snacking dependent variables separated by study and then meta-analysed.

	Snacking Type					
	Proportion healthy			Food choice		
	<i>r</i>	<i>P</i>	<i>g</i> [95% CI)	<i>r</i>	<i>P</i>	<i>g</i> [95% CI)
Study 5	-.13	.15		-.07	.44	
Study 6	-.001	.39		-.26	.03	
Study 7	-.10	.85		-.16	.20	
Meta-analysis			-.29 [-.52, -.06]			-.18 [-.41, .05]

5.7 Mega analysis

All studies were entered into the same dataset and the same analyses conducted on the individual studies were repeated on this one large dataset (see Sung et al., 2014). A significant effect of condition was found on the proportion of healthy snacks consumed, $F(1, 278) = 5.79, p = .003$. The healthy condition ($p = .003$), healthy negation ($p = .006$) and control ($p = .05$) conditions all consumed a significantly greater proportion of healthy snacks compared to the unhealthy not doing condition. This pattern was the same on the food choice data, where the unhealthy negation condition were significantly more likely to choose an unhealthy snack, $F(1, 290) = 5.07, p = .007, (M = -.42, SD = .88)$ compared to the healthy negation ($M = .03, SD = .93, p = .002$), healthy condition ($M = .06, SD = .91, p = .001$) and control conditions ($M = -.10, SD = .92, p = .03$). There was no effect of condition on the attitude accessibility difference score, $F(3, 288) = 2.15, p = .09, g = .17, 95\% CI [-.05, .40]$. A small, significant correlation was found between attitude accessibility and food choice, $r(287) = -.15, p = .01$, based on how these two variables were coded this supported greater accessibility of healthy snack words as associated with greater likelihood of choosing an unhealthy snack. No significant correlations were found between attitude accessibility and the two snacking behaviours; proportion of healthy snacks $r(287) = -.06, p = .33$.

5.8 General Discussion

The three studies reported in the present chapter aimed to investigate the influence of measuring intentions on subsequent healthy and unhealthy snacking assessed using both self-report and objective measures. They also aimed to extend the 'doing' and 'not doing' intention work that has been previously conducted by applying this within the QBE literature (Richetin et al., 2012; Levav & Fitzsimons, 2006), and empirically tested two mechanisms of the QBE (attitude accessibility and public commitment). A meta-analysis and mega-analysis of the three studies were also reported in order to overcome issues with low power produced by lab studies in this area.

The key findings from the three studies suggest that the focal behaviour used in QBE questions was key to the direction of effect produced. This pattern in results is inconsistent within the single studies themselves but appears to be clearer through the subsequent meta and mega-analyses where effect sizes reported for each of the

snacking dependent variables were consistently small-medium based on Cohen's *d* indication of magnitude of effect size (Cohen, 1988). This is concurrent with the findings from the meta-analysis presented in Chapter 2 which supported a small increase in healthy behaviours, ($g = .17$, 95% CI [.10, .24]), along with the small-medium effect sizes that are produced by studies conducted in the lab ($g = .33$, 95% CI [.19, .47]). While the results are not consistently supported for each behaviour in each of the studies, these are the first studies to provide some evidence to support the finding that asking about unhealthy behaviours can subsequently encourage greater performance of both self-reported and objectively measured behaviour. One potential cause of the inconsistency in effects could be explained as due to the low power of the individual studies. When the studies' results were combined and were subsequently then sufficiently powered to detect a difference, this then supports an overall increase in both healthy and unhealthy snacking dependent on which of these focal behaviours questions related to.

The three studies presented in this chapter are the first to compare the influence of questions relating to healthy and unhealthy behaviour within the same studies in a controlled lab environment. One advantage of these studies was that they all used a mixture of subjective and objectively measured behaviour to provide a better understanding of behaviour immediately after manipulation as well as in the following week. Both protection and health risk behaviours were assessed using the same measures, this should reduce potential confounds associated with measuring different behaviours in different ways. There are also few studies that are able to provide some objective measure of health-risk behaviours. This is despite the potential demand effects associated with QBE studies, whereby questioning may make individuals more likely to inaccurately self-report that they are behaving more healthily. Although the food choice task used in the present studies only gives a limited idea of the influence of the intervention, this combined with the self-report over longer term follow up, provides a clearer picture of the impact of the QBE than self-report alone.

The results differ to previous studies into the QBE in unhealthy snacking, as well as studies 2 and 4 presented in Chapter 4. Previous studies asked people to report the likelihood of eating fatty foods in the next week (Williams, Fitzsimons, & Block, 2004, study 1) and found a reduction in self-reported estimated fatty food consumption. One potential reason for the differing results between the Williams et al. (2004) study and the present three studies is the assessment of snacking used. They asked participants to

estimate the number of specifically fatty foods consumed whereas the present study asked for a fuller report of snacks consumed, which were then rated as healthy or unhealthy by the researcher. Reporting just fatty snacks may be more subject to memory biases than when participants were asked to report all snacks. However, in the second and third studies the experimenter rating snacks as healthy or unhealthy also has limitations. This may be less accurate as researchers have less information regarding the snacks, although typically snacks were easy to categorise or otherwise had their nutritional content looked up in order to categorise them.

The findings from the present three studies also do not support the previous suggestion by Richetin, Conner, and Perugini (2012) who suggested that there is a clear distinction between goal states of 'doing' vs. 'not doing,' although they did not apply this to a QBE context. Strack and Deutsch (2004) suggest that the negation meaning is not always processed, particularly if an individual experiences limits to their cognitive processing. Instead the same processing is activated as if the individual was presented with the regular affirmation, which might explain the lack of difference in the present studies between conditions using questions relating to 'doing' vs. 'not doing' the behaviour. In future studies the QBE could be investigated in unhealthy behaviours using questions that use an affirmation intention format rather than the negation question in order to confirm that it is the behavioural focus that is key and not related to potential difficulty in processing negation framed questions.

The present three studies did not provide support for attitude accessibility as a mediator of the QBE, despite a previous study supporting this in a similarly designed lab study (Wood et al., 2014). While study five found experimental participants had more accessible attitudes toward healthy snack words, this did not translate into behaviour. Neither of the other studies produced an increase in attitude accessibility. A review and meta-analysis by Cooke and Sheeran (2004) found support for the moderation of cognitions and behaviour through attitude accessibility. However attitude accessibility was found to be one of the weakest moderators of the four they assessed. The support within the QBE literature itself is mixed as can be seen from recent reviews (Wood et al., 2016), which showed little evidence to support any of the mechanisms tested. Potentially this is an issue with the validity of the latency measures that are generally employed in these studies, which were also used in the present three studies. These have previously not been validated and therefore it is not clear whether these are truly measuring attitude accessibility. This lack of validation may provide a potential

explanation for the null results relating to the influence of attitude accessibility on the QBE in the present three studies.

Rather than supporting attitude accessibility as a mechanism of the QBE it is likely that a processing fluency explanation may be more appropriate to explain the present findings. This would suggest that questions relating to behaviour activate scripts toward performing that behaviour and therefore increase the likelihood of it being performed, although this was not objectively measured in the studies. There are specific limitations of the individual studies. For one, study 5 assessed self-monitored behaviour over the week following the lab manipulation. It may be the case that this increased any influence of the QBE due to the effects of participants self-monitoring their own behaviour at various time points over the course of the week. In addition to this, participants in study 5 rated snacks as either healthy or unhealthy themselves in order to then calculate the proportion of healthy snacks consumed and their accuracy in this may depend on how much knowledge the participant has, although this was double checked for accuracy by the researcher. This was amended in studies 6 and 7 where a retrospective measure of snacking was used and the judgement about whether snacks were healthy or unhealthy was made by the experimenter. Use of a retrospective measure is likely to reduce any self-monitoring effects, however this may be less accurate as it is based on the participants' memory of the past week.

The three studies presented in this chapter were carried out in a lab setting. Based on evidence from the meta-analysis in Chapter 2 this was considered the most appropriate setting to manipulate minor factors such as the specific make-up of the question used. The pattern in the data from all three studies supported an increase in both protection and risk snacking behaviours as a result of questioning intentions relating to these. Whilst the results were inconsistent in the overall influence of the QBE on behaviour, the results were clearer when the results were analysed altogether in a meta-analysis and mega-analysis. This may be due to lack of power in the individual studies whereas the combined analyses were effectively powered to detect a difference. No influence of question framing was found where questioning intentions relating to 'doing' and 'not doing' behaviour both produced an increase in behaviour. No mediating effects of attitude accessibility were found, nor were any moderating effects of self-monitoring. In future it is a potential ethical issue to consider whether involving larger sample sizes in studies that are likely to increase performance of unhealthy behaviour is appropriate.

Chapter 6 **General discussion**

6.1 Thesis aims

The aim of this thesis was to investigate the influence of the QBE on risk behaviours, along with potential moderators of the effect. In order to investigate this, four key research questions were addressed in this thesis. These research questions were: (a) whether the QBE can be applied as a method to reduce risk behaviours (b) if not (a) then whether the QBE increases these risk behaviours (c) what moderators influence the QBE including the most appropriate forms of questioning to use in relation to health risk behaviours. It also aimed to provide an investigation of cognitive dissonance and attitude accessibility as potential mediators of the QBE. This final chapter aims to summarise the key findings of the studies reported here and to discuss how the present work addresses each of these research questions.

6.1.1 Gaps in the literature

The systematic review reported in Chapter 2 showed that few studies ($k = 16$) had been conducted to investigate the influence of questioning behavioural predictions or intentions on subsequent performance of health risk behaviours. It was therefore not known what potential influence the QBE might have on these types of behaviour. Previous studies had suggested that the QBE might both reduce (e.g., unhealthy snacking: Levav & Fitzsimons, 2006) and increase (e.g., illegal drug use: Williams, Block, & Fitzsimons, 2006) health risk behaviours, although the latter study's conclusions have been later questioned due to skew in the data. Due to there being so few studies in this area there was a distinct lack of understanding of both the direction of potential effect produced from applying the QBE to health risk behaviours and also the sorts of potential moderators that might influence the size of effect. The studies reported in this thesis aimed to investigate the QBE in a range of different study settings and using either intention or prediction questions in order to investigate the influence of these as potential moderators.

This work provides an original contribution to the QBE literature. Chapter 2 provides an in-depth review and meta-analysis of a greater number of methodological moderators than previous reviews of the literature (e.g., Rodrigues et al., 2015; Wood et al., 2016; Spangenberg et al., 2016). Studies 1-7, presented in Chapters 3-5, demonstrate the QBE in a range of settings using prediction or intention questions with

different question framing (not doing, avoiding, reducing) on a number of different behaviours that have not been previously investigated in the QBE literature. Two studies also investigated protection and risk alternatives of the same behaviour. This work provides a range of studies aiming to investigate the QBE in health risk behaviours and its potential moderators.

A total of six studies on the QBE have been published since the systematic review, identified by re-running the search from Chapter 2 (Hagoel et al., 2016; O'Carroll et al., 2015; McDermott et al., 2016; Boder, Duval, & Grohman, 2015; Poon, Koehler, & Buehler, 2014; Keatley et al., 2014), each study focused on protection health behaviours (colorectal cancer screening; general health screening) or purchasing behaviours. However, no recent studies have been published on the QBE in health risk behaviours. This provides further justification for the need for further studies of the QBE to better understand the methodological moderators of the QBE, along with particular focus on health risk behaviours.

6.2 Summary of studies conducted

A total of seven empirical studies are reported in the present work, in addition to the review and meta-analysis presented in Chapter 2; four studies were conducted in an online or field setting and three were conducted in a laboratory. The designs of each of the studies will be briefly described and their results summarised. First the results from individual studies will be summarised, followed by a more general overview of the study findings and how these relate to the research questions outlined in section 6.1.

Chapter 2 reported a systematic review and meta-analysis of studies that investigated the influence of measuring cognitions or behaviour at baseline on subsequent performance of behaviour. It also aimed to investigate the key methodological moderators that influence the QBE. The results of the systematic review and meta-analysis supported a small significant effect of questioning of intentions and predictions on behaviour. The results supported the QBE influences all types of behaviour: health, consumer, and other behaviours. We also found that the greatest QBE was produced in a lab setting. Study setting was also supported as the only significant moderator that remained when accounting for all other moderators. The review also demonstrated that the QBE was under significant influence of potential risk of bias, where a greater QBE was supported in studies that were at greater risk of bias according to ratings that were

given based on the Cochrane Collaborations risk of bias tool. This discussion section will attempt to explain the potential influence of these moderators on the findings in the present work (section 6.4), along with the mechanisms referred to in Chapter 1 (section 6.5).

Chapter 3 reported a schools based QBE intervention investigating the influence of assessing intentions relating to 'not smoking' along with smoking behaviour over a five year period. This was compared against a control group only assessed on their smoking intentions and behaviour at the final time point where participants were 15-16 years old. This study found that condition did not predict the proportion of participants who smoked at age 13-14 or age 15-16. Gender was found to be the only consistent predictor of smoking behaviour, with more female pupils reporting smoking compared to male pupils.

Chapter 4 reported three online studies of the QBE. The first of these (study 2) investigated the influence of asking prediction questions regarding a specific unhealthy snacking behaviour (biscuit consumption) on subsequent biscuit and general snack consumption over one week follow up. The study also measured the levels of dissonance participants experienced when thinking about their biscuit consumption. Study 2 found no effect of asking individuals to predict their likelihood of performing a specific unhealthy behaviour (eating biscuits). There were generally low levels of biscuit consumption in the sample. While reported prediction levels were found to be related to biscuit consumption, in that individuals who predicted that they would eat biscuits or that reported low levels of prediction to avoid eating biscuits were more likely to consume biscuits over the week long follow up, overall condition was not associated with biscuit consumption. This study demonstrated that asking prediction questions about a specific snacking behaviour (biscuit consumption) did not influence subsequent performance of this specific behaviour. The study also found no QBE on general snacking behaviour in the week following the QBE intervention.

Study 3 built on study 2 by including behaviours that individuals may be more motivated to change and therefore experienced more dissonance toward. This study aimed to investigate the influence of asking prediction questions on social smoking and drinking behaviour, separately and concurrently in individuals who were identified as social smokers who had smoked in the past month. Subsequent social smoking and drinking behaviour were assessed at one month follow up. Similar to study 2,

participants in study 3 were also assessed on their levels of dissonance when considering their social smoking and drinking behaviour.

The results of study 3 indicated there was no effect of the QBE on smoking or social smoking when individuals were asked to predict their likelihood of socially smoking over the following month. Individuals who were asked to predict their likelihood of socially smoking over the following month tended to be more likely to smoke than those asked about a non-health behaviour (using the internet), however the difference was not significant. When participants were asked to predict their likelihood of socially drinking over the following month, this also had no effect on their overall drinking levels over one month follow up. However, asking participants about their likelihood of both socially smoking and socially drinking increased their likelihood of socially drinking compared to when they were asked about just socially drinking alone. The level of dissonance participants reported when thinking about these behaviours was also found to be associated with cigarette smoking. Although this was not in the expected direction, where higher dissonance was associated with higher cigarette smoking. Finally, the data were reanalysed with non-smokers excluded from the data. For smokers, significantly more cigarettes were smoked after individuals had been asked to predict their levels of cigarette smoking compared to control.

The final online study presented in Chapter 4 reported a multi-behaviour study which investigated the influence of the QBE when asking a range of cognition and behaviour questions taken from the Theory of Planned Behaviour on six different health risk and health promotion behaviours. Subsequent performance of these six behaviours was assessed at one month follow up. Study 4 also investigated the influence of manipulating the level of dissonance experienced by participants by highlighting the importance of health and living a healthy lifestyle. The results of study 4 demonstrated that a QBE manipulation based on the Theory of Planned Behaviour could be used alone and combined with a manipulation focusing on dissonance to produce a reduction in three self-reported health risk behaviours assessed over four week follow up. The study also demonstrated that three health protection behaviours were increased, however this was only in the condition exposed to the additional dissonance manipulation.

Finally, Chapter 5 reported three lab studies that were analysed individually and combined using meta and mega analysis. These three studies investigated the influence of assessing intentions relating to healthy snacking (study 5 and 6) and intentions

relating to unhealthy snacking (study 6 and 7). Attitude accessibility was assessed as a mediator between questioning and behaviour. In all three studies snacking behaviour was assessed objectively by participants being offered a food choice between chocolate and fruit immediately after the lab component was completed. Participants were also asked to report their snacking behaviour in a retrospective snack diary for the week following the lab experiment. These three studies (5-7) demonstrated inconsistent findings in their investigation of the influence of asking participants to report their intentions to consume healthy and unhealthy snacks. Participants in the experimental condition in study 6 were asked to report their intentions to consume healthy snacks. These participants were subsequently significantly more likely to choose a healthy snack in the food choice paradigm. However, studies 5 and 7 found no QBE on the food choice data. The snack diary data showed significantly more healthy snacks were consumed by individuals asked about their intentions to consume healthy snacks in study 5, but no effect was found in study 6. Study 7 found a significant effect of asking individuals about their intentions to consume unhealthy snacks, where a greater proportion of unhealthy snacks were consumed after participants were asked about their intentions to perform this behaviour. Although the results from individual studies were inconsistent, a meta-analysis was performed on this data due to lack of power from the individual studies based on the sample sizes recruited. The results of this meta-analysis made the pattern of results clearer. The meta-analysis on the three lab studies' data supported a small increase in healthy snacking as a result of being asked to report intentions to perform healthy snacking ($g = .35$, 95% CI = .15, .56). It also supported a small increase in unhealthy snacking when this was the target behaviour in the intention items ($g = -.40$, 95% CI = -.63, -.16). The results of the meta-analysis therefore found support for the finding that the QBE increases both healthy and unhealthy behaviour when intentions are assessed in a lab setting. There were no effects of self-monitoring as a moderator of the QBE, and no effect of attitude accessibility as a mediator of the QBE in these three lab studies.

6.2.1 Meta-analysis

The present work included a range of studies which varied in terms of focal behaviour tested and study setting. Conducting a meta-analysis of the studies included in this work aims to provide a clearer picture of the overall impact of the QBE on the health risk behaviours targeted, along with the influence of these two key moderators. The overall effect produced in the present set of studies can then be compared against the

results from that produced in the studies included in the literature review from Chapter 2. In studies with multiple experimental conditions, the mean effect of these QBE conditions were combined and compared against a control, in study 4 the QBE only condition was compared against control. A random effects analysis was conducted. Based on the results of the seven studies reported here, an overall non-significant effect of the QBE was produced on the health behaviours, $g = .08$, $p = .06$, 95% CI[-.002, .16]. No significant QBE was found in health risk behaviours $g = .03$, 95% CI[-.07, .13] or health protection behaviours, $g = .16$, 95% CI[-.03, .30]. There was also no significant heterogeneity between studies influenced by *health behaviour type*, $Q = 2.51$, $p = .11$. Due to the focus of this work, the following analyses will relate only to the risk behaviours tested.

6.2.1.1 Moderators

6.2.1.1.1 Setting

There was no significant heterogeneity between studies influenced by *study setting*, $Q = 7.27$, $p = .51$. There was no significant QBE in behaviour in studies conducted in a lab setting $g = .22$, 95% CI[-.31, .76], no significant effect was produced on behaviour when the QBE was applied in an online setting $g = -.009$, 95% CI[-.12, .10], or in a field setting, $g = .21$, 95% CI[-.15, .56].

6.2.1.1.2 Behaviour

The studies were separated based on the specific behaviour investigated. Four risk behaviours were targeted in the seven studies. Table 6.1 presents the effect sizes, confidence intervals and n for each of the studies presented in this thesis. There was no significant heterogeneity between studies influenced by *behaviour*, $Q = 7.27$, $p = .51$. All effects on behaviour were non-significant. The meta-analysis supported a non-significant increase in smoking: $g = .17$, 95% CI[-.07, .41]; unhealthy snacking: $g = .07$, 95% CI[-.11, .26]. A non-significant reduction was supported in sedentariness: $g = -.11$, 95% CI[-.37, .15]; and alcohol consumption: $g = -.05$, 95% CI[-.25, .15]. All behaviours investigated were repeated rather than one-off behaviours and it may be the case that the QBE is not strong enough to promote change in these habitual risk behaviours.

Table 6.1. *Mini meta-analysis hedges g and 95% confidence intervals.*

Study	Behaviour	<i>g</i>	95% <i>CI</i>	<i>n</i>
Study 1	Smoking	.21	-.15, .56	1487
Study 2	Biscuit consumption	.07	-.15, .29	443
Study 3	Smoking	.14	-.19, .46	218
Study 3	Alcohol consumption	-.04	-.36, .29	206
Study 4	Alcohol consumption	-.06	-.32, .20	256
Study 4	Sedentariness	-.11	-.37, .15	256
Study 4	Unhealthy snacking	-.04	-.30, .22	256
Study 6	Unhealthy snacking	-.07	-.62, .48	62
Study 7	Unhealthy snacking	.47	.01, .93	93

6.2.2 QBE influences on risk behaviours

The first two research questions the present work aimed to address were: (a) whether the QBE can be applied as a method to reduce risk behaviours, and (b) if not (a) then whether the QBE increases these risk behaviours. The seven studies presented in this work therefore suggest inconsistent effects of the QBE on subsequent health risk behaviours. While studies 1, 2 and 3 found generally null effects of questioning cognitions and behavioural predictions on subsequent behaviour, study 4 found a significant reduction in health risk behaviours as a result of questioning cognitions taken from the Theory of Planned Behaviour. Finally, the three lab studies reported in Chapter 5 supported an increase in unhealthy snacking as a result of questioning intentions relating to this behaviour following the mini meta-analysis. This work therefore demonstrates that the QBE can both increase and reduce health risk

behaviours, as well as also producing null effects. The overall effects from the meta-analysis performed on the seven studies reported here supports an overall small and non-significant effect of the QBE (see section 6.3.1), it also supports an overall non-significant effect of the QBE when considering health risk behaviours alone. The overall non-significant effect on health risk behaviours appears to contradict the findings from study 4, however this is likely to be due to the meta-analysis combining QBE conditions, where study 4 found the greatest reduction in health risk behaviours was in the combined QBE + dissonance condition, rather than the QBE condition alone. In order to better understand the possible explanations for these results, the studies will be discussed in terms of both methodological moderators (section 6.4) and potential mechanisms (section 6.5).

6.3 Moderators

The third research question the present work aimed to address was: (c) what moderators influence the of the QBE including the most appropriate forms of questioning to use in relation to health risk behaviours. One moderator that was supported in Chapter 2 was the different QBE produced in differing behaviour. A total of seven behaviours were investigated in the present set of studies. These included: smoking (adolescent uptake: study 1 and social smoking: study 3); snacking (healthy: studies 5 and 6 and unhealthy snacking: studies 4, 6, 7); drinking (social: study 2 and general: study 4); along with fruit and vegetable intake, flossing, physical activity, and sedentary behaviour (all study 4).

In terms of these specific behaviours, the individual studies again produced inconsistent effects. The mini meta-analysis of studies reported above demonstrates that the only significant effects produced were in healthy snacking and all other behaviours were found not to be significantly influenced by the QBE. One key pattern demonstrated from this meta-analysis is that the majority of effects, while non-significant, tended to show a pattern for the QBE increasing behaviour, regardless of whether it was a health risk or health protective behaviour. A non-significant pattern supporting the QBE reducing behaviour was only supported in two of the behaviours tested (sedentariness and alcohol). However, there are issues with the strength of conclusions that can be drawn from this, where the present work aimed to investigate the QBE in a range of behaviours and therefore studies investigating the same behaviour differed in a range of

methodological factors or otherwise behaviours were only investigated in single studies.

The meta-analysis presented in Chapter 2 demonstrated an overall significant increase in health protection behaviours and no significant effect in health risk behaviours. This was suggested to be due to the type of study typically investigating the QBE in risk behaviours, where studies typically assessed behaviour at baseline rather than assessing behavioural predictions or intentions. These studies produced a mix of significant negative and null effects in studies of the same health risk behaviour, where twelve of the sixteen previously published studies targeted alcohol consumption.

In the studies focusing on alcohol consumption reviewed in Chapter 2, four studies found a significant reduction in alcohol consumption in student samples only. The four studies that used patient samples, recruited typically from emergency rooms using participants who were likely to engage in heavy drinking, found null effects. When looking solely at the studies that focused on student samples, a further four studies found null effects. There did not appear to be a clear explanation for this inconsistency in results. Studies finding a significant reduction included studies using pen and paper questioning (McCambridge & Day, 2008) and online using the AUDIT (Kypri & McAnally, 2007) and a questionnaire based on the TPB (Todd & Mullan, 2011). However Kypri and McAnally (2005) and Moreira (2012) found no effect of using a computerised AUDIT questionnaire. There was not a consistent pattern in the non-patient samples to explain the different results produced by differing studies. One potential explanation could be due to the use of the AUDIT questionnaire as the measure of behaviour, this focuses on drinking to a hazardous level and when used in samples that do not recognise their drinking as potentially hazardous (e.g. students) this may be less likely to motivate behaviour change as a result of completing the questionnaire. The studies reported in this thesis appear to provide further support for an overall non-significant effect of the QBE on health risk behaviours.

Study setting was found to be a significant moderator of the QBE in the meta-analysis presented in Chapter 2; a greater effect was produced in studies conducted in a lab compared to other study settings. This was also backed up by the present studies, where a significant increase in health risk behaviours was reported in the lab studies presented in Chapter 5 and either null effects or a reduction in behaviour were produced in the online studies presented in Chapter 4 and null effects were produced in Chapter 3, although there were issues with recruiting an appropriate comparison group in this

study. This provides further support for the influence of study setting over the QBE, although study setting was found to be a non-significant moderator when this was analysed in the mini meta-analysis reported in section 6.3.1, although a significant effect was produced in the lab studies presented in this work and no significant effect was produced in the field or online studies. One potential explanation for the moderating effect of setting on the QBE could be due to the level of experimenter involvement in the study. Typically lab studies involve greater contact with the experimenter, who is unlikely to be blinded to the condition that participants are allocated to and therefore unintentional effects of experimenter bias are more likely to be a factor (e.g., Higgins, Altman, & Sterne, 2011). However, in Chapter 5 of the present work, participants completed the questionnaire and attitude accessibility measure on a computer. Despite this they are more likely to feel less anonymity in answering compared to when completing questionnaires online (Booth-Kewley, Larson, & Miyoshi, 2007). In the present studies this does not explain why an increase in risk behaviours was produced in the lab studies, where reduced anonymity would be expected to influence behaviour in a socially desirable direction, rather than the opposite as evidenced in the present studies (e.g., Sherman 1980). A potential explanation for the increase in behaviour could be explained by reactance effects (Brehm, 1966) where individuals feel that their behaviour is being manipulated and act in the opposite way to this perceived manipulation. Future studies could manipulate the reactance experienced by individuals in relation to questioning risk behaviours, this will be discussed further in relation to the potential applicability of the QBE as a public health intervention (section 6.7.2.1).

An alternative explanation could be due to the mechanisms underlying the effect, which may differ dependent on setting. This will be discussed further in section 6.6. For example, priming of intentions may be stronger within a lab setting with fewer distractions available (Clifford & Jerrit, 2014) where the participant is more likely to focus on the responses they give and subsequently act in accordance with these. The lab studies reported in Chapter 5 also had greater focus on the target behaviour of snacking, where in addition to the intention and attitude questionnaire, participants also completed an attitude accessibility task followed by the food choice task. This level of focus on the behaviour is likely to have provided stronger activation, particularly when considering a recent study by Keatley, et al., (2014) which found that using implicit measures can influence subsequent behaviour. Studies 2 and 3 used very brief

questioning of predictions and attitudes toward behaviour using an online, anonymous questionnaire. This may have reduced the potential depth of processing compared to the lab studies.

The fourth and final research question addressed in this work focused on the most appropriate forms of questioning to use in relation to health risk behaviours. In order to investigate this, a number of studies were conducted using different question types. The specific question framing was also manipulated in four studies (study 2 and Chapter 5). Questions also ranged in the number of items participants were exposed to, although this was not demonstrated to be a significant moderator in the meta-analysis presented in Chapter 2 and there are likely confounding variables that explain the different effect sizes produced in the present work in studies using more or fewer questionnaire items.

Overall the present work does not provide support for different QBE influences as a result of question framing. This partially supports the one previous study to specifically investigate whether framing questions as ‘doing’ or ‘not doing’ differently influenced the QBE (Levav & Fitzsimons, 2006). The present study found no framing differences, between whether questions related to ‘doing,’ ‘not doing,’ or ‘avoiding’ behaviour, despite previous work not in the QBE literature suggesting that intention framing is processed differently (Richetin et al., 2012) and despite other studies supporting significant differences from QBE questions framed differently (e.g., Godin et al., 2013) – although this investigated the influence of questioning using declarative vs. interrogative question formats.

6.4 Mechanisms

The two key mechanisms suggested to underlie the QBE and supported by previous literature (cognitive dissonance and attitude accessibility) were investigated in Chapters 4 and 5 respectively. The results of the previous published studies of the QBE in risk behaviours, along with the studies presented here will now be discussed in terms of the key mechanisms described in Chapter 1: attitude accessibility, cognitive dissonance and processing fluency.

6.4.1 Attitude accessibility

The attitude accessibility viewpoint as outlined in section 1.2.1 suggests that answering questions activates an individual’s attitude toward the behaviour so if behaviour is subsequently prompted they are then likely to act in-line with their attitude. The present

work does not appear to support attitude accessibility as a mechanism of the QBE. In the three studies that directly assessed attitude accessibility as a mediator (Chapter 5) attitude accessibility was assessed using a reaction time task, where shorter reaction times toward healthy and unhealthy snacking indicated greater accessibility of participants' attitudes toward these. However, this did not mediate the relationship between questioning and behaviour.

One potential explanation for the lack of support for attitude accessibility as a mediator could be due to the use of question framings including 'not doing' or 'avoiding' behaviour which are likely to be harder to mentally represent than when asking about general intention (Levav & Fitzsimons, 2006). This may therefore cause issues with the activation of the mental representation of attitudes toward the behaviour and therefore lead to the lack of effect evidenced here. Also, attitude accessibility was only assessed in the lab studies presented here, it is therefore not possible to conclude the overall influence of this mechanism over the non-lab studies. The present set of studies did not use a question framing relating to 'doing' the risk behaviours and therefore this remains a gap in the literature.

An alternative explanation for the lack of support for attitude accessibility as a mechanism of the QBE when applied to health risk behaviours refers to a point made by Moore and Fitzsimons (2008) who suggest that attitudes toward health risk behaviours are likely to be more ambivalent than attitudes toward other health behaviours, in part due to the hedonic nature of many health risk behaviours (Leigh, 1999). If multiple conflicting attitudes are activated through questioning, then this may at least in part explain the inconsistent results produced in studies of the QBE in health risk behaviours, whereby it may be the most salient of these attitudes that is activated. This viewpoint will now be discussed in terms of the reported attitudes in each of the present studies.

6.4.2 Attitude ambivalence

Moore and Fitzsimons (2008) suggested that individuals may be aware that health risk behaviours tend to be bad for their health, but they continue to perform them if they are enjoyable or they have other good evaluations toward performing the behaviour. The results of the present studies do seem to provide some support for this. Table E1 (in appendix E) presents the attitudes for common behaviours investigated across more than one study. For example, participants tended to report that not performing/avoiding

the health risk behaviours would be ‘unpleasant’ but would be ‘beneficial’ and this might explain why attitudes did not mediate the relationship. This is in-line with previous work by Lawton, Conner and Parker (2007) which supported affective beliefs as more powerful predictors of two risk behaviours (speeding and smoking) than cognition-based attitudes.

Study 2 attitudes were around the midpoint for the four different attitudes reported (not enjoyable-enjoyable; bad-good; harmful-beneficial; worthwhile-not worthwhile) although they were most positive about enjoying consuming biscuits ($M = 3.69$ on a five point scale). In study 3, participants were aware that reducing social smoking and drinking would be beneficial and worthwhile, however were around the mid-point for the level of enjoyment regarding reducing behaviour. Study 4 found participants attitudes were highest relating to enjoyment relating to avoiding drinking more than the recommended levels, although this was around the midpoint for unhealthy snacking. Participants were also likely to report that avoiding these two behaviours was worthwhile and important. This pattern of ambivalence in enjoyment was also reported in Chapter 5 where participants were also likely to rate reducing unhealthy snacking as ‘good’ and ‘beneficial’, however this did not translate into a reduction in behaviour. These findings do support the suggestions by Moore & Fitzsimons (2008) suggesting that individuals are likely to have mixed or ambivalent attitudes toward their performance of risk behaviours. The present set of studies consistently found that attitudes relating to the level of ‘enjoyment’ relating to reducing their health risk behaviours was around the midpoint, however participants were also aware that avoiding or reducing these behaviours was ‘beneficial’ to health and ‘worthwhile’. This pattern was demonstrated in each of the studies and did not differ between studies producing a null effect (study 2 and 3), a reduction in behaviour (study 4), or an increase in health risk behaviours (study 6 and 7). This therefore demonstrates that individuals’ attitudes toward health risk behaviours are likely to be mixed, however the present set of studies did not demonstrate a clear pattern as to the influence of these attitudes over behaviour. It is therefore unclear what influence attitudes have over health risk behaviours. Future studies would benefit from assessing the salience of specific attitudes, in order to better understand the impact of these different attitudes over their behaviour.

6.4.3 Motivational or dissonance account

A motivational or dissonance account of the QBE was investigated in the online studies presented in Chapter 4. Self-reported dissonance in relation to the focal behaviours was assessed at follow up in studies 2 and 3. Dissonance was also directly manipulated in study 4. Unfortunately neither study 2 or 3 found any effect of condition on behaviour and therefore self-reported dissonance could not be assessed as a mediator. The self-reported measure of dissonance was supported as a predictor of behaviour, however this appeared to be in the opposite direction to that expected, where greater dissonance was associated with greater behaviour performance. Participants in studies 2 and 3 reported low dissonance ratings and the subsequent lack of QBE produced in studies 2 and 3 appeared to support motivation and dissonance as being important in producing a QBE. A potential explanation could be that questioning increases participant recognition and awareness of their enjoyment of the behaviour which could subsequently increase behaviour in order to bring in-line with their positive affective attitudes. As stated previously in section 6.6, the dissonance measure used in studies 2 and 3 had not been previously validated, an additional issue was that dissonance was only assessed at follow up in order to reduce contamination effects with the QBE intervention. However, this meant that dissonance levels were only assessed in those individuals who agreed to provide data at follow up. Individuals who felt high levels of psychological discomfort at time 1 would potentially be less likely to provide responses at time 2.

The dissonance motivation in study 4 does seem to support this as being influential over the QBE, whereby effects were greater in individuals exposed to the added dissonance manipulation in protection behaviours, although both the QBE alone and combined with the dissonance manipulation reduced the targeted risk behaviours. The present studies and the meta-analysis presented in Chapter 2 appear to support the QBE as producing small changes in health behaviours, however individuals require sufficient motivation toward the behaviour for the QBE to produce a reduction in health risk behaviours. As previously stated, the studies presented here did not specifically target individuals with an interest or motivation to change their health behaviours. Instead, study advertisement was vague about the specific study aims and the behaviours that would be focused on. The QBE may be more influential if it applied within populations who are targeted due to their interest in changing their behaviour.

6.4.3.1 Question context

Spangenberg et al. (2016) suggest that dissonance is most likely to be activated using general questions, rather than questioning specific behaviours. This may explain the significant reduction in risk behaviours supported in only one of the present set of studies (study 4). Study 4 presented the questions about health risk behaviours within a larger questionnaire which targeted a range of cognitions along with a range of different protection and risk behaviours. Gollwitzer and Oettingen (2008) suggested that the context in which QBE questions are presented is likely to influence the direction of effect produced on health risk behaviours. This study also suggested that reference points may be key to the QBE, study 4 was the only study to provide clear reference points by providing the recommended levels of behaviour for each of the six focal behaviours tested.

Study 4 questioned behaviours within a context of adhering to a healthy lifestyle, where each behaviour and healthy levels of performance were defined prior to questioning. This framing of the questions within a context of living a healthy lifestyle may have produced a kind of priming effect toward performing general healthy behaviours, with the specific behaviour questions priming these behaviours. In terms of the mechanisms outlined previously, this could be explained through a mixture of attitude accessibility and processing fluency. Activation of individuals' attitudes toward behaviour may be ineffective in producing a change in behaviour without concurrent activation of general health attitudes and scripts toward changing general behaviour. This therefore may have increased participant awareness of their general performance of health behaviours and increased general levels of dissonance which led to behaviour change. However, the levels of motivation to change and dissonance toward behaviour were not assessed in the QBE condition that was not also exposed to the dissonance manipulation, therefore it is not possible to ascertain the level of dissonance participants experienced in completing the QBE questions alone.

In addition to this, the provision of context by stating what levels of behaviour were recommended also provided a normative reference for participants in study 4 that could potentially produce a dissonance type reaction more than in contexts where participants are not aware of normative or recommended levels of behaviour. Future research would benefit from investigating the influence of providing normative information such as recommended levels of behaviour and assessing the influence of this on the QBE and also over levels of reported dissonance.

6.4.4 Processing fluency

The majority of studies presented here appear to support a kind of processing fluency explanation underlying the QBE; whereby the framing of specific questions was not supported as being influential over subsequent behaviour. This suggests that the focal behaviour included in the question as key to any effect of questioning on behaviour. Levav and Fitzsimons (2006) previously suggested that negation aspects of questions are not mentally represented, this appears to be supported in the present studies. The present work supports the influence of the context of questioning, which has had limited focus in studies of the QBE previously. Future studies would benefit from the development of measures of processing fluency and also directly comparing the influence of questioning within a health context, compared to when questions are presented in a standalone fashion, without associating this with general health benefits.

Based on the findings from the present set of studies, there was not one clear mechanism underlying the results found. The present work did not assess more than one mechanism at one time. It would therefore be beneficial in future studies to directly assess multiple mechanisms at once, as it is unlikely that a single mechanism underlies the QBE. There are a number of issues with investigating multiple mechanisms at once particularly in a non-lab setting. At present there are no validated measures of the mechanisms underlying the QBE and measures of attitude accessibility have only previously been applied in the lab. A recent study also demonstrated that using implicit measures can subsequently influence behaviour (Keatley, Clarke, Ferguson, & Hagger, 2014), therefore in assessing multiple mechanisms this might interfere with the measures of additional mechanisms along with subsequent behaviour.

6.5 Strengths and limitations of the work

The present work has a number of strengths. It is the first set of studies to investigate the influence of the QBE over a range of health risk behaviours. It is also the first work to demonstrate that the QBE can be applied to manipulate multiple health behaviours at once and show that questioning of cognitions and behaviour online can produce a change in both protection and health risk behaviours, whereby study 4 demonstrated that fruit and vegetable consumption was increased as a result of questioning, and sedentariness was reduced. It also includes the first set of studies conducted in a controlled lab environment to demonstrate that the QBE can increase both protection and risk alternatives of the same health behaviour (snacking). While this may seem contradictory, it does demonstrate the potential influence that the simple act of

questioning can have on behaviour. It also shows that methodological factors are key to the potential influence of the QBE. This work includes a number of studies conducted in an overall wide ranging sample of participants ranging from adolescents, to University students, and finally to non-student adults. Studies 4 and 5-7 when combined were appropriately powered to detect an effect, despite the large sample sizes required due to the generally small effects produced by the QBE and the subject attrition in studies 2 and 3. The present work also attempted to gain a better understanding of the QBE by investigating a number of potential mechanisms of the effect.

However, there are also a number of weaknesses of the studies presented here that may limit our understanding along with the applicability of findings. Firstly, the majority of studies relied on self-reported data at follow up, despite the high potential for participants to suffer from demand characteristic effects (Mankarious & Kothe, 2014) whereby they respond only as they think that they should, and this is magnified as a result of having their behaviour questioned. This was mainly due to the lack of possible objective measures of data – in terms of smoking this would involve taking carbon monoxide or cotinine measures from participants which would likely have made recruitment more difficult and also would have increased the resources required. An alternative might have been to use bogus pipeline measures (e.g., McCambridge et al., 2013) whereby participants believe that at some point their biological data will be requested, this is suggested to increase the accuracy of responding. This was not carried out in the present set of studies, partly due to the three studies that lacked any objective measure being conducted online, therefore participants may have felt uncomfortable with providing details for the bogus pipeline measure and this could have increased self-selection bias. Since a number of the present studies show null effects and some of the data suggests an increase in risk behaviours, this suggests that the potential demand characteristics had a smaller influence than has previously been suggested.

A second issue with the present studies is their general reliance on non-validated measures of behaviour. This was justified as to reduce participant burden and so reduce potential attrition. A number of the behaviours questioned (e.g., social smoking/drinking) have had limited previous research focusing on them so there was a lack of pre-validated measures of these behaviours. However, this reduces the overall validity of the study findings. Future studies would benefit from using pre-validated questionnaires such as the Timeline Follow Back questionnaires to produce a more

reliable and valid measure of subsequent behaviour. Also, the measures used to assess mechanisms of the QBE: dissonance and attitude accessibility, had not been previously validated. The dissonance measure showed good internal consistency and the attitude accessibility measure had been found to moderate the QBE by a previous study (Wood et al., 2014). However, there were no pre-validated measures of dissonance and individuals in studies 2 and 3 tended to have low scores on this measure of dissonance. Future studies would benefit from developing a validated measure of dissonance, potentially by combining a self-reported measure with a physiological measure to detect psychological discomfort associated with answering behaviour related questions.

A number of the studies reported here were underpowered due to participant attrition (study 3) and issues with recruiting a sufficiently sized comparison group (study 1). The studies in Chapter 5 were also underpowered individually, however this was due to the exploratory nature of the studies whereby the sample sizes were based on those used in similar, previously conducted studies of the QBE in the lab. The lack of power in the individual studies was addressed through the combined analyses. The studies were designed to have a number of overlapping aspects in order to allow this combined analysis, however a single study conducted in the lab on an adequately powered sample size would reduce any potential confounding variables from conducting three separate studies and that may have influenced the results.

Study 1 also demonstrated some of the difficulties with recruiting adequately sized comparison groups within QBE research. Recruiting assessment only conditions involves few of the potential benefits of taking part in research that might otherwise motivate participation in behaviour change research, where participants are only in contact with the experimenter typically on a single occasion and the study cannot be advertised as aiming to change behaviour. One potential method to avoid disproportionately sized comparison conditions might be to recruit at baseline, however there is likely to be attrition over longitudinal follow up and individuals or schools are unlikely to agree to take part in research that will be conducted a number of years in the future. This difficulty in recruiting assessment only conditions should be taken into consideration when designing QBE studies.

Another limitation of the present research was that participants recruited in all of the studies were not responding to advertisements to change their behaviour. Participants therefore may have had lower motivation to change compared to participants exposed to more in-depth interventions, where participant recruitment is advertised to

individuals already interested in changing their behaviour. The present set of studies were all vague in their advertisement and did not mention that they were aiming to change participant behaviour, this was to reduce any potential reactance effects (Brehm, 1966), whereby participants are aware that they are being manipulated and so act in a way that is opposite to how they feel they are being pressured to behave. Future QBE studies may benefit from investigating whether a stronger QBE is produced when individuals recruited to the study already have motivation or interest in changing their behaviour and are aware that they will be involved in a behaviour change intervention. However, it has been previously suggested that awareness of the intervention subsequently makes the QBE less likely to have an effect on behaviour (Williams et al., 2004). On the other hand, there are potential ethical implications to consider when participants are recruited if they are unaware that they are being exposed to an intervention to change their behaviour, particularly as there is potential for this to increase their negative health behaviours.

6.6 Implications

6.6.1 Theoretical implications

As previously stated in this discussion section, the present studies demonstrate mixed evidence of the influence of questioning behaviour on health risk behaviours and this corresponds with the findings of the literature review from Chapter 2. The results demonstrate that in some cases the QBE had no effect on behaviour (e.g., studies 2 and 3), however one study found a reduction in one of the target risk behaviours (study 4). Finally, the lab studies presented in Chapter 5 demonstrated that the QBE has potential to increase health risk behaviours. In terms of Moore and Fitzsimons' (2008) suggestion that the QBE can have unintentional influences on health risk behaviours where these behaviours are increased, we provide some support for this, however the pattern in results is not straightforward. Instead the results support the idea that in some settings the QBE may encourage the performance of health risk behaviours, while in others it has no effect on subsequent behaviour or when combined with an additional manipulation was demonstrated to reduce performance of these behaviours.

In the present work a number of studies (study 4 and 6) tested the QBE in both protection and health risk behaviours within the same study. This reduces potential confounding effects of assessing different behaviours in different studies and appeared

to support different results dependent on whether the focal behaviour was a protection or a health risk behaviour. This demonstrates that the same intervention cannot necessarily be applied to different types of behaviour under the assumption that this will change behaviour in a direction that promotes a healthy lifestyle (i.e., Encouraging healthy behaviour and reducing risk behaviours). As discussed in section 6.6, further research is required to understand the exact mechanisms that underlie different effects of the QBE in protection vs. risk behaviours.

One issue that is raised by the different QBE produced in lab compared to non-lab settings relates to the potential applicability of QBE findings based in the lab to a real life or online setting. If lab studies are activating different mechanisms or are otherwise producing different QBE effects on behaviour compared to non-lab studies, then this reduces the generalisability of findings from a lab to the field/online and vice versa. This produces problems if the QBE is to be applied as a public health intervention, where it would be more beneficial to conduct studies in the setting they are likely to be applied, in real life. While some real-life settings share similar conditions to lab settings for example conducting measures in a healthcare setting completed by health professionals, this is not always the case and the setting a QBE intervention is applied in should be considered. In addition to this, the majority of studies of the potential mechanisms underlying the QBE have been conducted in a lab setting (e.g., Janisewski & Chandon, 2007; Morwitz & Fitzsimons, 2004). It would be more beneficial to our understanding of the QBE if mechanisms and moderators are investigated using a field or online study setting to better understand what factors influence the QBE in the setting it is likely to be applied in.

Chapter 2 demonstrated the influence of risk of bias over the QBE, where a greater QBE was produced in studies with a non-RCT design and in those rated as greater risk of bias. Chapter 5 of the present work then demonstrated a greater effect of the QBE in studies conducted in the lab using a non-RCT design. Including these kind of high risk of bias studies within meta-analyses without consideration of their design could potentially exaggerate the influence of the QBE and therefore false conclusions could be drawn regarding the potential impact of questioning on behaviour. Particularly due to the small nature of the effect produced in studies with a strong design, meta-analyses of the QBE should include consideration of the design used when meta-analysing the results of multiple studies.

6.6.2 Practical implications

There are two key areas where the present work may inform practice. The first is in terms of using the QBE as a public health intervention to improve health outcomes and the second is the potential for questioning to produce unintentional effects on behaviour as part of other interventions or research. Both of these will now be discussed in turn in relation to what the present work can add to our understanding of these two differing issues.

6.6.2.1 The QBE as a public health intervention

First, due to the inconsistent results demonstrated in the present work and the potential to increase health risk behaviours, the findings of this thesis do not support the QBE as a public health intervention. The mini meta-analysis of the studies presented here support an overall non-significant effect of the QBE on health risk behaviours. While study 4 demonstrated that multiple risk behaviours were reduced as a result of questioning, it appears motivation is key and this study was the only one of the seven presented here to clearly state recommended levels of behaviour and place the QBE intervention within a general health context. Further understanding is required of the key mechanisms underlying the QBE in these behaviours along with the moderators that are most likely to produce a consistent reduction in these behaviours.

The present set of studies suggest that the QBE alone is not enough to change risk behaviours consistently where it potentially requires participants to be already motivated to change or possibly additional manipulations. One of the benefits of QBE interventions that have previously been conducted in protection behaviours (e.g., blood donation) is the low level of resources required to produce a small but significant effect on behaviour (e.g., Godin et al., 2008; 2013). However the present work demonstrates that there can be potentially harmful effects of a QBE intervention, whereby health risk behaviours can be increased or encouraged, particularly if individuals have positive attitudes toward performing behaviour and low motivation to change. Rather than encouraging a reduction in behaviour, the questioning may act as a prime that encourages greater behaviour. It is likely that the QBE needs to be administered in individuals targeted due to their current motivation to change their levels of health risk behaviours. However due to the potential issues with reactance effects (Brehm, 1966) outlined previously in section 6.4, further research would benefit from comparing the effect size of these potential reactance effects against the potential benefits of applying a QBE intervention to individuals with motivation to change. It may be the case that reactance effects are more likely in individuals who are unwilling to change and

therefore have low motivation, where making motivated individuals aware of the purpose of the intervention may not produce the same reactance effects; further research that directly manipulates reactance effects and motivation in the QBE is required to better understand this.

In relation to applying the QBE as a public health intervention there is also a need for further investigation of the context that the intervention is applied in. The current research was all conducted with individuals that were generally assumed to be healthy and was not targeted at individuals who would have particular motivation to change their levels of health risk behaviours due to illness or another significant life event. Future research could investigate the influence of the QBE in these individuals already predisposed to change their behaviour (e.g., after illness diagnosis), although it is likely that the levels of behaviour participants would perform in these samples would be much greater than in the generally healthy samples tested in the present work. In addition to this, due to the moderating effect of setting on the QBE, it would be worthwhile investigating the QBE under contexts and settings that have not previously been tested such as during a patient-practitioner consultation in a general practice setting.

6.6.2.2 Unintentional effects of questioning on behaviour

The present work also provides partial support for the influence of cognition and behaviour assessments on subsequent behaviour, therefore providing some support for the unintentional effects of questioning on behaviour (e.g., McCambridge, de Bruin, & Witton, 2012). Assessing behaviour and cognitions therefore needs to be considered as a potentially influential part of research. Based on the present work it is unclear under which circumstances the QBE does not influence behaviour. The present research does not consistently support any particular question frame as having no impact over behaviour. Further research is required to better understand the circumstances where assessments relating to behaviour do not impact subsequent behaviour. The present work also demonstrated that the greatest effect of the QBE is produced in lab studies, which typically focus on recruiting university students, although it is not clear why the effect is greater in this setting. Study 1 also demonstrated some of the difficulties with attempting to investigate the impact of assessment alongside an intervention, where schools were reluctant to be recruited into assessment only conditions.

Sometimes the QBE is undesirable such as when cognitions and behaviour are assessed at baseline as part of an intervention, or during general screening in a healthcare setting. Researchers should be aware of the potential influence of assessments that relate to behaviour and be particularly cautious when conducting research in the lab or when investigating other interventions without considering the potential for these assessments to influence behaviour. As it is still unclear the circumstances where a QBE is consistently not produced, an alternative course of action could be for researchers conducting interventions including assessment at baseline to include an unassessed control in order to separate assessment effects from those of the active intervention. However, this can require additional resources that are not always available and is often not a priority for researchers. The research conducted in Chapter 3 also demonstrates some of the difficulties of attempting to collect unassessed control group data without randomising individuals to a non-assessed control at baseline. However it is also difficult to risk subject attrition where individuals are not allocated to any specific intervention, particularly if they are motivated to change their behaviour. At present it is also unclear how the potential influence of questioning could be reduced as part of screening in a healthcare setting. Further research is required into the specific types of question and question contexts that can reliably be used in order not to influence subsequent behaviour performance.

One of the key findings demonstrated in the meta-analysis presented in Chapter 2 was the potential for risk of bias influences over the QBE, this suggested that the QBE is inflated by risk of bias in study designs. These findings echoed that by Rodrigues et al. (2015) who gave suggestions of QBE trials requiring pre-registration to reduce the likelihood of risk of bias effects. There are studies demonstrating that the QBE can influence behaviour under circumstances where risk of bias is very low (e.g., Godin et al., 2008; Conner et al., 2010; study 4 in the present work). At present it is unclear exactly how these risk of bias effects influence the QBE and further research would benefit from systematically manipulating and testing the influence of risk of bias over the QBE to better understand this, so that future studies can risk inflating the influence of the QBE due to the influence of bias.

6.7 Suggestions for future research

This discussion section has already provided some suggestions for future research such as the need for studies manipulating risk of bias on the QBE, each of these suggestions

will now be outlined in more detail to provide some potential ideas for future research in this area and as a result of the present work's original contribution to the literature.

There is a need for further investigation of whether the QBE can be applied to reliably reduce risk behaviours. One suggestion from the present set of studies would be to compare questioning within the context of other health behaviours and provide recommendations for levels of behaviour against a regular QBE condition where these recommended levels and contextual information are not provided. Studies would benefit from selecting behaviours where individuals are likely to perform behaviours consistently and those which they have motivation to change. Alternatively, it would be worthwhile identifying and investigating QBE influences over less frequent or non-routine risk behaviours that have less habitual influence.

A further unanswered question based on the present work is how researchers can reliably use assessments without influencing subsequent behaviour. Further investigation is required into specific questioning framing and context is required to better understand the circumstances where questioning reliably does not have an influence over behaviour. The present set of studies demonstrate that framing questions in terms of 'doing', 'not doing', or 'avoiding' behaviour did not influence the effect of specific questioning. One avenue for future research would be to manipulate reactance effects (see Brehm, 1966) on the QBE when applied to health risk behaviours. There have been a limited number of studies to investigate whether making participants aware of the potential influence of the QBE over their subsequent behaviour reduces any QBE produced (e.g., Williams et al., 2004). If individuals are more conscious of the idea that they are being manipulated this has been previously supported to reduce a QBE, but has received little attention generally. Future studies could explicitly inform participants about the use of the QBE to change behaviour and compare this against a condition who are not given this information, the extent that participants felt they were being manipulated and whether they felt this influenced their responding could also be explicitly assessed.

The present set of studies appears to support the importance of motivation over the QBE and previous studies have demonstrated that the QBE typically occurs in individuals that have high intentions to performing behaviour. One explanation for the inconsistency in QBE influences in the present set of studies could be explained by low levels of motivation toward behaviour. Future studies would benefit from explicitly assessing motivation or alternatively providing additional manipulations that aim to

influence levels of motivation toward behaviour. As previously stated in earlier sections of this discussion (section 6.6.3), studies could also specifically target individuals who are likely to have high motivation to change their behaviour in order to investigate the influence of this over the QBE.

There are a small number of potential issues associated with these suggestions. Firstly, by assessing motivation as part of the baseline QBE questionnaire could influence the QBE in itself above and beyond the effects of assessing other cognitions. Secondly, if motivation were only assessed at follow up, this would only include individuals who agreed to complete both parts of the study and were not influenced by attrition effects, therefore these individuals would be more likely to have high motivation toward behaviour than individuals who dropped out between time 1 and time 2. In relation to targeting only motivated individuals, this has some issues with the way in which QBE interventions as RCTs have been delivered (e.g., Conner et al., 2009, 2011; Godin et al., 2008; 2011; 2013) where this involves a very low level of effort as a large number of individuals are sent questionnaires and those who choose to complete the questionnaires are exposed to the QBE. However this is something that may not be a viable option in relation to health risk behaviours whereby there appears to be some likelihood of the QBE priming behaviour and therefore encouraging greater performance of behaviour, rather than less.

6.8 Conclusion

This thesis aimed to investigate the influence of questioning cognitions and/or behaviour (the question-behaviour effect; QBE) on subsequent performance of health risk behaviours. A comprehensive systematic review of the literature and meta-analysis was conducted, along with seven empirical studies of the QBE within a range of settings (field, online, and laboratory). The studies found inconsistent overall effects of the QBE on risk behaviours. Studies found the QBE to have potential to both increase and reduce health risk behaviours, where study setting, risk of bias, and motivation appear to be key to the direction of effect. The results demonstrate that assessment of cognitions can potentially influence health risk behaviours and in some settings may actually increase the performance of risk behaviours. It also demonstrates that there is some potential to apply the QBE as an intervention to reduce health risk behaviours when combined with another manipulation aiming to increase dissonance. Further

research is required to understand the circumstances where questioning can reliably reduce health risk behaviours.

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- *References included in Chapter 2 literature review and meta-analysis.

List of abbreviations

ANOVA	Analysis of Variance
ASH	Action on Smoking and Health
AUDIT	Alcohol Use Disorders Identification Test
CMA	Comprehensive meta-analysis software
FSM	Free school meals
HBV	Hepatitis B
HSCIC	Health and Social Care Information Centre
MANOVA	Multivariate analysis of variance
NICE	The National Institute for Health and Care Excellence
Pap smear test	Papanicolaou smear test
QBE	Question-behaviour effect
RCT	Randomised Controlled Trial
SD	Standard Deviation
SE	Standard Error
TPB	Theory of Planned Behaviour
WHO	World Health Organisation

Appendices

APPENDIX A: Literature review and meta-analysis additional materials

Appendix A1. PROSPERO protocol registration details.

PROSPERO International prospective register of systematic reviews

Review title and timescale

1 Review title

Give the working title of the review. This must be in English. Ideally it should state succinctly the interventions or exposures being reviewed and the associated health or social problem being addressed in the review.

A systematic review of question-behaviour effect, mere measurement, self prophesy and assessment reactivity studies

2 Original language title

For reviews in languages other than English, this field should be used to enter the title in the language of the review. This will be displayed together with the English language title.

3 Anticipated or actual start date

Give the date when the systematic review commenced, or is expected to commence.

21/10/2013

4 Anticipated completion date

Give the date by which the review is expected to be completed.

30/10/2015

5 Stage of review at time of this submission

Indicate the stage of progress of the review by ticking the relevant boxes. Reviews that have progressed beyond the point of completing data extraction at the time of initial registration are not eligible for inclusion in PROSPERO. This field should be updated when any amendments are made to a published record.

The review has not yet started

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

Provide any other relevant information about the stage of the review here.

Review team details

6 Named contact

The named contact acts as the guarantor for the accuracy of the information presented in the register record.

Sarah Wilding

7 Named contact email

Enter the electronic mail address of the named contact.

ps12seh@leeds.ac.uk

8 Named contact address

Enter the full postal address for the named contact.

Institute of Psychological Sciences University of Leeds Leeds UK LS2 9JT

9 Named contact phone number

Enter the telephone number for the named contact, including international dialing code.

+44 (0)113 3439195

10 Organisational affiliation of the review

Full title of the organisational affiliations for this review, and website address if available. This field may be completed as 'None' if the review is not affiliated to any organisation.

University of Leeds

Website address:

11 Review team members and their organisational affiliations

Give the title, first name and last name of all members of the team working directly on the review. Give the organisational affiliations of each member of the review team.

Title	First name	Last name	Affiliation
Ms	Sarah	Wilding	Leeds University

Professor	Mark	Conner	Leeds University
Professor	Rebecca	Lawton	Leeds University
Dr	Andy	Prestwich	Leeds University

12 Funding sources/sponsors

Give details of the individuals, organizations, groups or other legal entities who take responsibility for initiating, managing, sponsoring and/or financing the review. Any unique identification numbers assigned to the review by the individuals or bodies listed should be included.

As part of a PhD project funded by the MRC

13 Conflicts of interest

List any conditions that could lead to actual or perceived undue influence on judgements concerning the main topic investigated in the review.

Are there any actual or potential conflicts of interest?

None known

14 Collaborators

Give the name, affiliation and role of any individuals or organisations who are working on the review but who are not listed as review team members.

Title	First name	Last name	Organisation details
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Review methods

15 Review question(s)

State the question(s) to be addressed / review objectives. Please complete a separate box for each question.

To what extent does asking questions about cognitions or behaviour alter subsequent performance of behaviour?

What kinds of methodologies have been used to test this?

16 Searches

Give details of the sources to be searched, and any restrictions (e.g. language or publication period). The full search strategy is not required, but may be supplied as a link or attachment.

OVID Embase, PsycInfo, Medline databases will be searched . Studies published in English between 1980 up to 9.04.15 Web of Science and Google Scholar will be used for citation searching of key articles. Reference lists of each identified study will be used as will reference lists of review articles in the areas.

17 URL to search strategy

If you have one, give the link to your search strategy here. Alternatively you can e-mail this to

PROSPERO and we will store and link to it.

I give permission for this file to be made publicly available

Yes

- 18 Condition or domain being studied
- Give a short description of the disease, condition or healthcare domain being studied. This could include health and wellbeing outcomes.
- All health related outcomes that have been tested. Along with non health related outcomes.
- 19 Participants/population
- Give summary criteria for the participants or populations being studied by the review. The preferred format includes details of both inclusion and exclusion criteria.
- No exclusion based on population used.
- 20 Intervention(s), exposure(s)
- Give full and clear descriptions of the nature of the interventions or the exposures to be reviewed
- Include if: 1) At least one condition is questioned on cognitions and/or behaviour and one condition is not (or is questioned on different cognitions and/or behaviour) 2) There is a measure of cognitions and/or behaviour after the intervention Exclude if: 1) A non-human sample is used 2) The paper is an existing review 3) The paper is a commentary on the effect 4) The two conditions differ on behaviour change techniques other than being questioned on cognitions and/or behaviour (including self-monitoring of behaviour or goal outcomes) 5) The paper is a dissertation, an abstract only or a book chapter 6) The paper is not published in the English language
- 21 Comparator(s)/control
- Where relevant, give details of the alternatives against which the main subject/topic of the review will be compared (e.g. another intervention or a non-exposed control group).
- The key comparator conditions can include non exposed control groups, delayed assessment control groups. Additional comparator groups may include alternative treatment conditions.
- 22 Types of study to be included
- Give details of the study designs to be included in the review. If there are no restrictions on the types of study design eligible for inclusion, this should be stated.
- There are no restrictions for the type of study design included. These may include RCTs, non RCTs, solomon three or four group designs
- 23 Context
- Give summary details of the setting and other relevant characteristics which help define the inclusion or exclusion criteria.

Studies included from all settings. No exclusion criteria for study settings.

24 Primary outcome(s)

Give the most important outcomes.

Behaviour compared to a control group.

Give information on timing and effect measures, as appropriate.

This must be measured after the questioning intervention. When multiple time points are measured, comparisons will be made for each of these and at the final time point assessment.

25 Secondary outcomes

List any additional outcomes that will be addressed. If there are no secondary outcomes enter None.

Post intervention changes in cognition.

Give information on timing and effect measures, as appropriate.

These will again be measured after the intervention.

26 Data extraction (selection and coding)

Give the procedure for selecting studies for the review and extracting data, including the number of researchers involved and how discrepancies will be resolved. List the data to be extracted.

MEDLINE, PsycInfo and Embase will be searched using OVID, using search criteria aiming to identify studies that cover question-behaviour research, the impact of assessment on behaviour and also interventions that have independently assessed the effect of measurement on behaviour. Titles and/or abstracts will be screened independently for inclusion by two authors. A full text version of potentially eligible studies will be assessed independently by two review authors. Any disagreements will be resolved through discussion between the independent authors and one other review author. Data extraction will be carried out using a standardised form. Extracted data will include: study design and methodology, information for assessment of risk of bias, details of recruitment and study setting, intervention details, details of comparison groups and outcome data. One review author will extract data independently. 20% of the extracted studies will then be independently extracted independently by two review authors. Discrepancies will be resolved through discussion.

27 Risk of bias (quality) assessment

State whether and how risk of bias will be assessed, how the quality of individual studies will be assessed, and whether and how this will influence the planned synthesis.

Risk of bias will be assessed using the Cochrane's risk of bias tool. Data will be checked for: randomization sequence generation, allocation concealment, blinding, completeness of outcome data, selective outcome reporting and other potential sources of bias.

28 Strategy for data synthesis

Give the planned general approach to be used, for example whether the data to be used will be aggregate or at the level of individual participants, and whether a quantitative or narrative

(descriptive) synthesis is planned. Where appropriate a brief outline of analytic approach should be given.

A narrative synthesis of the literature is planned. Structured around the type of behavioural outcome measure, intervention content and methods used. If included studies are found to be methodologically homogenous a meta-analysis will be carried out.

29 Analysis of subgroups or subsets

Give any planned exploration of subgroups or subsets within the review. 'None planned' is a valid response if no subgroup analyses are planned.

Subgroup analyses will be carried out on randomized controlled trials included. Also subgroup analyses will be carried out for each type of behaviour measured.

Review general information

30 Type and method of review

Select the type of review and the review method from the drop down list.

Intervention, Systematic review

31 Language

Select the language(s) in which the review is being written and will be made available, from the drop down list. Use the control key to select more than one language.

English

Will a summary/abstract be made available in English?

Yes

32 Country

Select the country in which the review is being carried out from the drop down list. For multi-national collaborations select all the countries involved. Use the control key to select more than one country.

England

33 Other registration details

Give the name of any organisation where the systematic review title or protocol is registered together with any unique identification number assigned. If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here.

34 Reference and/or URL for published protocol

Give the citation for the published protocol, if there is one.

Give the link to the published protocol, if there is one. This may be to an external site or to a protocol deposited with CRD in pdf format.

I give permission for this file to be made publicly available

Yes

35 Dissemination plans

Give brief details of plans for communicating essential messages from the review to the appropriate audiences.

Do you intend to publish the review on completion?

Yes

36 Keywords

Give words or phrases that best describe the review. (One word per box, create a new box for each term)

Systematic review

Question-behaviour

Behaviour assessment

Behaviour change intervention

37 Details of any existing review of the same topic by the same authors

Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible.

None.

38 Current review status

Review status should be updated when the review is completed and when it is published.

Ongoing

39 Any additional information

Provide any further information the review team consider relevant to the registration of the review.

40 Details of final report/publication(s)

This field should be left empty until details of the completed review are available.

Give the full citation for the final report or publication of the systematic review.

Give the URL where available.

Appendix A2. List of search terms from literature review

The following terms were used to search electronic databases for appropriate studies: *'question behavior?r OR mere measure* OR self-prediction OR self-prophecy OR self-generated validity OR self-erasing nature of errors of prediction OR measurement reactivity OR (assessment adj reactivity) OR assessment effect)(solomon adj2^a design) OR solomon) adj2 study) OR solomon) adj2 group) OR solomon) adj4 design) OR solomon) adj3 study) OR solomon) adj3 studies) NOT solomon=author NOT solomon) adj3 island) OR (Question* adj3 behaviour adj3 participation) OR (demand characteristics OR Hawthorne effect)) AND measure* AND participant*.'*

^a adj is words adjacent to within titles and key terms.

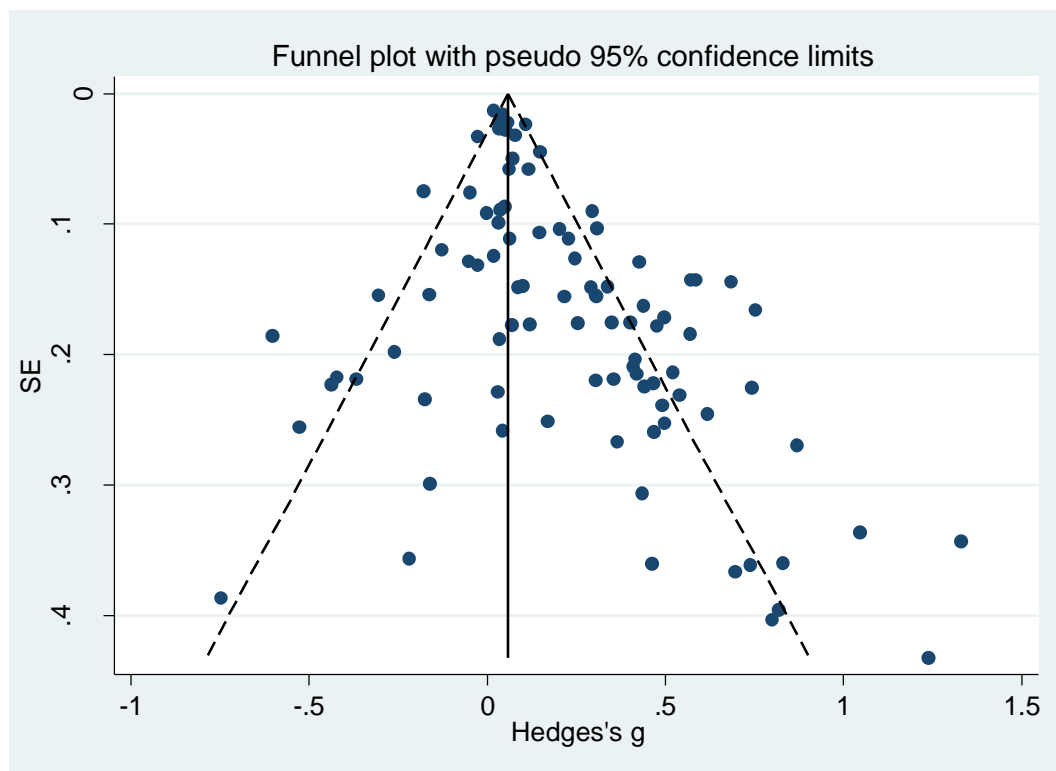


Figure A1. Meta-analysis funnel plot.

Table A1. Meta-analysis bias score rated from 0-6

Bias total	<i>k</i>	<i>g</i>	CI	<i>p</i>	<i>I</i> ²	<i>Q</i>
0	20	.06	0.03, 0.09	0.00	28.83	31.28
1	4	.04	-0.08, 0.17	0.519	30.64	
2	9	.13	0.01, 0.26	0.04	70.25	
3	3	-.03	-0.39, 0.33	0.88	65.33	
4	10	.37	0.18, 0.57	0.00	56.14	
5	2	.38	0.14, 0.63	0.00	.00	
6	35	.24	0.15, 0.33	0.00	81.24	

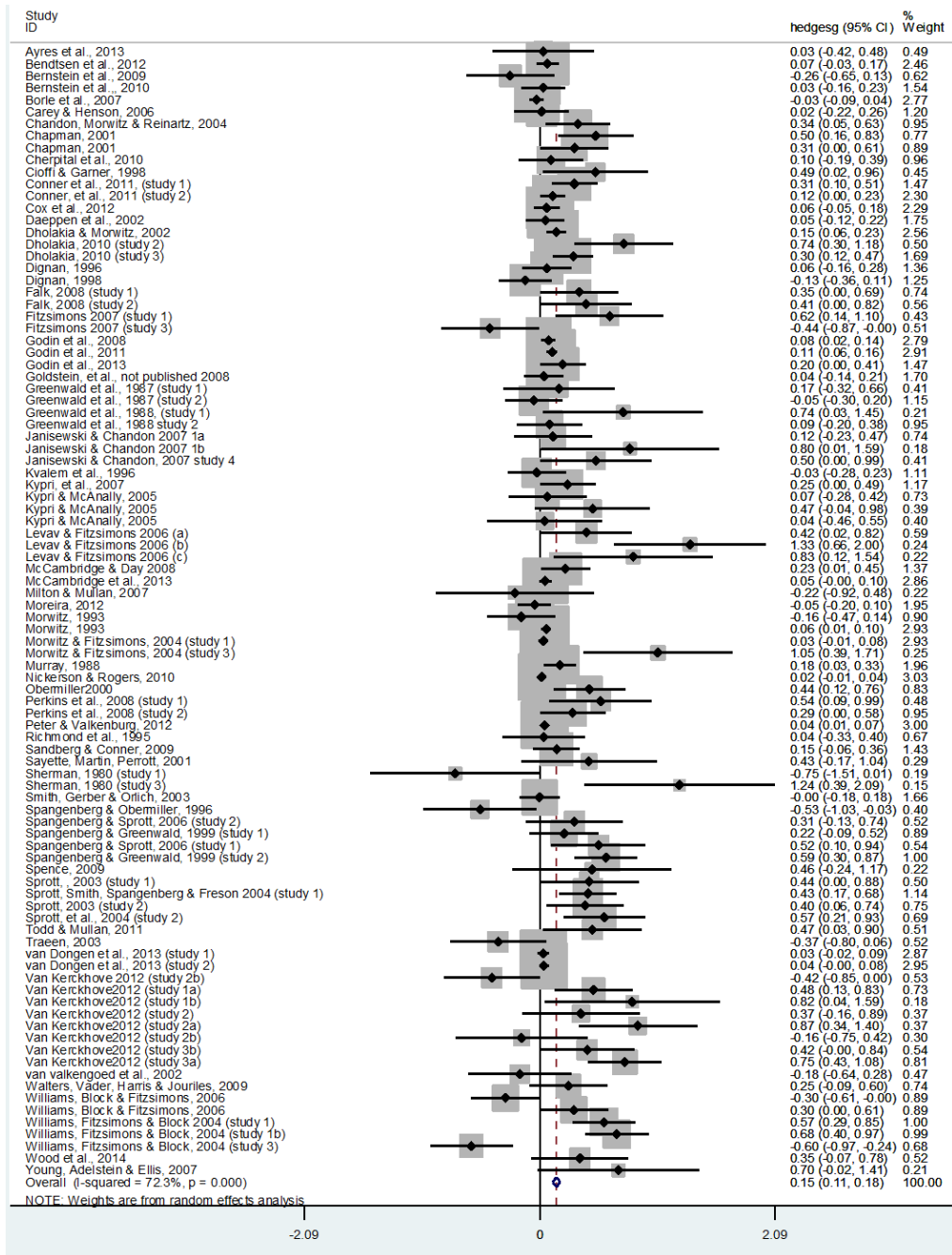


Figure A2. Study effect sizes from random effects meta-analysis. Diamonds represent Hedges' g effect size, horizontal lines indicate 95% confidence intervals and shaded sections indicate study percentage weight.

Appendix B: Questionnaire materials

Appendix B1: Study 1 materials

Experimental questionnaire

You have the right to decide not to complete the questionnaire if you don't want to. But please tick this box if you are happy to take part in this study

2. Do you smoke cigarettes these days? Yes No

1.a) I am: a boy a girl b) My age: ___ ___ years

3. Who smokes in your family now? Tick all the people who smoke at the moment: Mum (including step-mum) Dad (including step-dad) Grandma Grandad Older brother (including step-brother) Younger brother (including step-brother) Older sister (including step-sister) Younger sister (including step-sister) Other people. Who? Please list in this box No-one smokes in my family

4. Read the following statements carefully and tick the ONE that describes you. I have never smoked I have only ever tried smoking once I used to smoke sometimes, but I never smoke cigarettes now I sometimes smoke cigarettes now, but I don't smoke as many as one a week I usually smoke between one and six cigarettes a week I usually smoke more than six cigarettes a week

6. How many of your friends smoke? All of them; Most but not all; Half and half; Only a few; None of them

5. ONLY answer this question if you have never smoked or only tried it once. a) Put a tick beside the statement that best describes you: I have never had one puff of a cigarette I did once have a puff of a cigarette I have tried smoking a few times, but I never smoke now I do sometimes smoke cigarettes, but not as many as one a week
b) How many times have you been offered a cigarette?

c) How many times did you smoke the cigarette? d) What did you usually do or say when offered a cigarette?

For these next questions, tick ONE box per question to show what you think.

7.a) I am confident I could resist smoking: strongly agree- strongly disagree

b) For me to not smoke would be: easy - difficult

c) How much control do you feel you have over not smoking? Complete control - no control

8. a) Most of my friends think... b) My best male friend thinks... c) My best female friend thinks... d) My family think... e) People who are important to me think...

I should smoke I should not smoke

9. a) I plan not to smoke: Strongly disagree Strongly Agree

b) I don't want to smoke: : Strongly disagree
 Strongly Agree

c) I will try not to smoke: : Strongly disagree
 Strongly Agree

10. a) I can say no to smoking, even at school:

Strongly disagree Strongly Agree

b) I can say no to smoking even when I'm offered a cigarette:

: Strongly disagree Strongly Agree

c) I can say no to smoking, even if my friends want me to smoke:

: Strongly disagree Strongly Agree

d) I can say no to smoking, even if I was the only one in the group not smoking:

: Strongly disagree Strongly Agree

e) I can say no to smoking, even if I feel a bit left out of the group:

: Strongly disagree Strongly Agree

f) I can say no to smoking, even if I feel like smoking:

: Strongly disagree Strongly Agree

11. Tick one box for each question to show what you think. For me, smoking would be...

Bad Good

Harmful Beneficial

Unpleasant Pleasant

Unenjoyable Enjoyable

Foolish Wise

Not fun Fun

Healthy Unhealthy

12. An e-cigarette or vapouriser is a tube that sometimes looks like a normal cigarette and has a glowing tip. They all puff a vapour that looks like smoke but unlike normal cigarettes, they don't burn tobacco. Have you ever heard of e-cigarettes or vapourisers? (Please tick one box)

These questions ask about your experience of e-cigarettes and/or vapourisers

Yes I have No I haven't I don't know

13. Which ONE of the following is closest to describing your experience of e-cigarettes or vapourisers? (Please tick one box)

I have never used them I have tried them once or twice I use them sometimes (more than once a month but less than once a week) I use them often (more than once a week)

Instructions These next 9 questions ask about how you are today. For each question, read all the choices and decide which one is most like you today. Then put a tick in the box next to it like this . Only tick one box for each question.

I don't feel upset today

I feel a little bit upset today

I feel a bit upset today

I feel quite upset today

I feel very upset today

These last questions ask about how you are today

1. Worried

I don't feel worried today

I feel a little bit worried today

I feel a bit worried today

I feel quite worried today

I feel very worried today

2. Sad

I don't feel sad today

I feel a little bit sad today

I feel a bit sad today I feel quite sad today

I feel very sad today 3. Pain

I don't have any pain today

I have a little bit of pain today

I have a bit of pain today I have quite a lot of pain today

I have a lot of pain today

4. Tired

I don't feel tired today

I feel a little bit tired today

I feel a bit tired today

I feel quite tired today

I feel very tired today 5. Annoyed

I don't feel annoyed today

I feel a little annoyed today

I feel a bit annoyed today I feel quite annoyed today

I feel very annoyed today

6. School Work/Homework (such as reading, writing, doing lessons)

I have no problems with my schoolwork/homework today

I have a few problems with my schoolwork/homework today

I have some problems with my schoolwork/homework today

I have many problems with my schoolwork/homework today

I can't do my schoolwork/homework today

7. Sleep

- Last night I had no problems sleeping
- Last night I had a few problems sleeping
- Last night I had some problems sleeping
- Last night I had many problems sleeping
- Last night I couldn't sleep at all

8. Daily routine (things like eating, having a bath/shower, getting dressed)

- I have no problems with my daily routine today
- I have a few problems with my daily routine today
- I have some problems with my daily routine today
- I have many problems with my daily routine today
- I can't do my daily routine today

9. Able to join in activities (things like playing out with your friends, doing sports, joining in things)

- I can join in any activities today
- I can join in with most activities today
- I can join in with some activities today
- I can join in with a few activities today
- I can join in with no activities today

Control questionnaire:

- 1) I am: a boy a girl
- 2) My age: years
- 3) Read the following statements carefully and tick the ONE that describes you
 - I have never smoked
 - I have only ever tried smoking once
 - I used to smoke sometimes, but I never smoke cigarettes now
 - I sometimes smoke cigarettes now, but I don't smoke as many as one a week
 - I usually smoke between one and six cigarettes a week
 - I usually smoke more than six cigarettes a week

4) ONLY answer this question if you have never smoked or only tried it once,

- I have never had one puff of a cigarette
- I did once have a puff of a cigarette
- I have tried smoking a few times, but I never smoke now
- I do sometimes smoke cigarettes, but not as many as one a week

5) Since this time yesterday have you smoked at all?

- Yes I have smoked one or more than one cigarette
- Yes I have smoked a few puffs but not a whole cigarette
- No I have not smoked.

6) Intentions

I plan not to smoke:

Strongly disagree Strongly Agree

I don't want to smoke

Strongly disagree Strongly Agree

I will try not to smoke

Strongly disagree Strongly Agree

Appendix B2: Study 2 materials

Doing condition:

Do you predict that you will eat biscuits in the next week?

1	2	3	4	5
Definitely no				Definitely Yes

How likely are you to eat biscuits as a snack in the next week?

1	2	3	4	5
Not at all likely				Highly likely

Will you eat biscuits as a snack in the next week?

1	2	3	4	5
Definitely no				Definitely Yes

Would eating biscuits in the next week be...

1	2	3	4	5
Not enjoyable				Enjoyable

1	2	3	4	5
Bad				Good

1	2	3	4	5
Harmful				Beneficial

1	2	3	4	5
Not worthwhile				Worthwhile

1	2	3	4	5
---	---	---	---	---

Avoid questions

Do you predict that you will avoid eating biscuits in the next week?

1

2

3

4

5

Definitely no

Definitely Yes

Snack diary**INSTRUCTIONS**

We would now like you to think about your eating habits for the past week. Your blank 7-day snack diary starts on the reverse side of this sheet. To fill in, please indicate how many snacks you consumed throughout the day and specify what each snack was (please write zero if no snacks were consumed during the specified period). *For the purposes of this study, a snack is any food that you consume between main meals.*

Try to make sure you recall all snacks. Please write the day of the week in the space provided to help you keep track of your diary entries.

To aid you in filling out your snack diary, there is an example snack diary entry below.

EXAMPLE SNACK DIARY

Day 1 (today): <u>Monday</u>	Snack Consumption
Before lunch	0
Between lunch and dinner	1 apple, 1 Flake chocolate bar
After dinner	1 packet of crisps, 1 banana

Day 2: <u>Tuesday</u>	Snack Consumption
Before lunch	1 mars bar, 1 cupcake

Between lunch and dinner	1 orange, 1 nectarine
After dinner	0

SNACK DIARY

Please indicate how many snacks you consumed throughout the day and specify what each snack was (please write zero if no snacks were consumed during the specified period). *For the purposes of this study, a snack is any food that you consume between main meals.*

Please write the day of the week in the space provided to help you keep track of your diary entries.

Please start filling out your first diary entry (for today) below.

Then please indicate the total number of **biscuits** you consumed on each of the days from the past week.

Day 1 (today): _____	Snack Consumption
Before lunch	
Between lunch and dinner	
After dinner	

--	--

Estimated number of biscuits consumed:

Day 2: (yesterday) _____	Snack Consumption
Before lunch	
Between lunch and dinner	
After dinner	

Estimated number of biscuits consumed:

Day 3: _____	Snack Consumption
Before lunch	
Between lunch and dinner	

After dinner	
---------------------	--

Estimated number of biscuits consumed:

Day 4: _____	Snack Consumption
Before lunch	
Between lunch and dinner	
After dinner	

Estimated number of biscuits consumed:

Day 5: _____	Snack Consumption
Before lunch	
Between lunch and dinner	

After dinner	
---------------------	--

Estimated number of biscuits consumed:

Day 6: _____	Snack Consumption
Before lunch	
Between lunch and dinner	
After dinner	

Estimated number of biscuits consumed:

Day 7: _____	Snack Consumption
Before lunch	
Between lunch and dinner	

After dinner	

Please now indicate the number of biscuits you consumed each day of the past week
(starting from today).

Please note we are referring to 'biscuits' using the UK/Commonwealth definition, which
are commonly known as cookies in American English.

Cognitive dissonance items:

Question 1. Thinking about my biscuit consumption makes me feel uncomfortable
(Where 1 is strongly disagree and 7 is strongly agree)

Question 2. Thinking about my biscuit consumption makes me feel uneasy (Where 1 is strongly disagree and 7 is strongly agree)

Question 3. Thinking about my biscuit consumption makes me feel anxious (Where 1 is strongly disagree and 7 is strongly agree)

Question 4. I worry about my biscuit consumption (Where 1 is strongly disagree and 7 is strongly agree)

Question 5. The difference between how many biscuits I think I should consume and how many I do makes me uncomfortable.
(Where 1 is strongly disagree and 7 is strongly agree)

Appendix B3: Study 3 Materials

Screening questionnaire

Assess whether they are a social smoker and if they drink, assess how often they have consumed alcohol in the past week/ month. Only participants who report both social smoking and consuming alcohol will be able to take part in the study.

- 1) For assessing cigarette use, respondents asked whether they have smoked a cigarette; response options are:
 “Never used,” “used but not in the past 12 months,” “used but not in the past 30 days,” or, “used in the past 30 days.”
- 2) In the past 30 days, did you smoke mainly when you are with people, mainly when you are alone, or do you smoke as often by yourself as with others? Mainly with people, Mainly alone, As often by yourself as with others, N/A.
- 3) How soon after waking do you smoke your first cigarette (Within 5 minutes, 5-30 minutes, 31-60 minutes, Longer than this, N/A)

AUDIT- C-

- 1) How often do you have a drink containing alcohol
 (Never, Monthly or less, 2-4 times a month, 2-3 times a week, 4 or more times a week)
- 2) How many units of alcohol do you drink on a typical day where you are drinking?
 (1 or 2 drinks, 3 or 4 drinks, 5 or 6 drinks, 7/8/9 drinks, 10 or more drinks)
- 3) How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?
 (Never, Less than monthly, Monthly, Weekly, Daily or almost daily)

Prediction questions:

Assess demographics (gender, age, occupation),

Smoking questionnaire

- 1) Do you predict you will reduce the number of cigarettes you smoke in the next month?

1	2	3	4	5
Definitely not			Definitely yes	

- 2) How likely are you to reduce your smoking in the next month?

1	2	3	4	5
Not at likely			Highly likely	

- 3) When you are with friends in the next month do you predict you will reduce your smoking?

1	2	3	4	5
Definitely not			Definitely yes	

For me, reducing my smoking in the next month would be...

- | | | | | |
|------------------|---|---|-----------|---|
| 1 | 2 | 3 | 4 | 5 |
| 4) Not enjoyable | | | Enjoyable | |

- | | | | | |
|--------|---|---|------|---|
| 1 | 2 | 3 | 4 | 5 |
| 5) Bad | | | Good | |

- | | | | | |
|------------|---|---|------------|---|
| 1 | 2 | 3 | 4 | 5 |
| 6) Harmful | | | Beneficial | |

- | | | | | |
|-------------------|---|---|------------|---|
| 1 | 2 | 3 | 4 | 5 |
| 7) Not worthwhile | | | Worthwhile | |

Drinking questionnaire

1) Do you predict you will reduce your alcohol consumption in the next month?

1 2 3 4 5

Definitely not

Definitely yes

2) How likely are you to reduce your alcohol consumption in the next month?

1 2 3 4 5

Not at likely

Highly likely

3) When you are with friends in the next month do you predict you will reduce your alcohol consumption?

1 2 3 4 5

Definitely not

Definitely yes

For me, reducing my drinking in the next month would be...

1 2 3 4 5

4) Not enjoyable

Enjoyable

1 2 3 4 5

5) Bad

Good

1 2 3 4 5

6) Harmful

Beneficial

1 2 3 4 5

7) Not worthwhile

Worthwhile

Combined questionnaire

- 1) Do you predict you will reduce the number of cigarettes smoked in the next month?
- | | | | | |
|----------------|---|---|----------------|---|
| 1 | 2 | 3 | 4 | 5 |
| Definitely not | | | Definitely yes | |
- 2) How likely are you to reduce your smoking in the next month?
- | | | | | |
|---------------|---|---|---------------|---|
| 1 | 2 | 3 | 4 | 5 |
| Not at likely | | | Highly likely | |
- 3) When you are with friends in the next month do you predict you will reduce your smoking?
- | | | | | |
|----------------|---|---|----------------|---|
| 1 | 2 | 3 | 4 | 5 |
| Definitely not | | | Definitely yes | |
- 4) Do you predict you will reduce your alcohol consumption in the next month?
- | | | | | |
|----------------|---|---|----------------|---|
| 1 | 2 | 3 | 4 | 5 |
| Definitely not | | | Definitely yes | |
- 5) How likely are you to reduce your alcohol intake in the next month?
- | | | | | |
|---------------|---|---|---------------|---|
| 1 | 2 | 3 | 4 | 5 |
| Not at likely | | | Highly likely | |
- 6) When you are with friends in the next month do you predict you will reduce your alcohol intake?
- | | | | | |
|----------------|---|---|----------------|---|
| 1 | 2 | 3 | 4 | 5 |
| Definitely not | | | Definitely yes | |
- 7) Do you predict you will smoke a cigarette while drinking alcohol in the next month?
- | | | | | |
|----------------|---|---|----------------|---|
| 1 | 2 | 3 | 4 | 5 |
| Definitely not | | | Definitely yes | |

8) Will you smoke a cigarette when under the influence of alcohol in the next month?

1 2 3 4 5

Definitely not

Definitely yes

For me, reducing my smoking and drinking in the next month would be...

1 2 3 4 5

9) Not enjoyable

Enjoyable

1 2 3 4 5

10) Bad

Good

1 2 3 4 5

11) Harmful

Beneficial

1 2 3 4 5

12) Not worthwhile

Worthwhile

Control questionnaire

1) Do you predict you will use the internet in the next month?

1 2 3 4 5

Definitely not

Definitely yes

2) How likely are you to use the internet in the next month?

1 2 3 4 5

Not at likely

Highly likely

3) In your free time will you use the internet in the next month?

1 2 3 4 5

Definitely not

Definitely yes

For me, using the internet in the next month would be...

1 2 3 4 5

4) Not enjoyable

Enjoyable

1 2 3 4 5

5) Bad

Good

1 2 3 4 5

6) Harmful

Beneficial

1 2 3 4 5

7) Not worthwhile

Worthwhile

Appendix B4: Study 4 Materials

Dissonance manipulation

The way that you choose to behave can have a **major** impact on your health and wellbeing. Up to 1/3 of cancers and 80% of heart disease, stroke and Type 2 diabetes could be prevented if smoking, unhealthy diet, lack of physical activity and alcohol use were removed as risk factors.

It's really important to make the choice to behave in a healthy way to increase your chances of living a long and healthy life. By this we mean eating at least 5 portions of fruit and vegetables per day, engaging in regular physical activity each day and having good oral hygiene by flossing once a day. It also means NOT sitting still for extended amounts of time without standing up each day, NOT eating fatty and sugary snacks each day, or NOT drinking over your recommended allowance of alcohol each day. Make the healthy choice!

The next set of questions will ask you about eating fruit and vegetables. The current recommendations in the UK suggest individuals should consume **at least five portions of fruit and vegetables per day**. One portion is the equivalent of one apple, banana or orange, or two kiwis, or one large slice of melon. A portion of vegetables is the equivalent of three tablespoons of cooked vegetables, one medium tomato, or two broccoli spears.

QBE questionnaire

- 1) I am likely to **eat five fruit and vegetables a day** over the next four weeks:
- 2) I intend to **eat five fruit and vegetables a day** over the next four weeks
- 3) I want to **eat five fruit and vegetables a day** over the next four weeks
- 4) I feel I should **eat five fruit and vegetables a day** over the next four weeks
- 5) How many portions of **fruit and vegetables** would you expect to consume per day over the next four weeks?portions
- 6) If it were entirely up to me, I am confident that I could **eat five fruit and vegetables a day** over the next four weeks:

- 7) How much control do you believe you have over **eating five fruit and vegetables a day** (No control – Complete control)
- 8) **Eating five fruit and vegetables a day** over the next four weeks would be:
(Worthwhile-Worthless;
- 9) Not enjoyable-Enjoyable;
- 10) Important-Unimportant;
- 11) Unpleasant-Pleasant)
- 12) Most people important to me think that: (I should-I should not) **eat five fruit or vegetables a day** over the next four weeks
- 13) I think that most people who are important to me **eat five fruit and vegetables a day**
- 14) I would prioritize eating at least **five portions of fruits and vegetables a day** over other goals important to me (Strongly disagree- strongly agree)
- 15) Is eating **fruit and vegetables** something that you do at the same times and in the same places each time? (Definitely No – Definitely Yes).

The next set of questions refer to the recommended levels of physical activity. This includes engaging in a minimum of 150 minutes of moderate activity (e.g. cycling or fast walking) or 75 minutes of vigorous activity (e.g. running), or a mixture of vigorous and moderate activity every week plus strength exercises on two or more days a week that work all the major muscles (legs, hips, back, abdomen, chest, shoulders and arms). This means engaging in **at least 20 minutes of moderate or vigorous activity per day.**

- 1) I am likely to engage in **the recommended levels of physical activity per day** over the next four weeks
- 2) I intend to engage in **the recommended levels of physical activity per day** over the next four weeks:
- 3) I want to engage in **the recommended levels of physical activity per day** over the next four weeks
- 4) I feel I should engage in **the recommended levels of physical activity per day** over the next four weeks
- 5) How many minutes of physical activity would you expect to engage in per day over the next four weeks? _____ minutes per day

- 6) If it were entirely up to me, I am confident that I could **engage in the recommended levels of physical activity per day** over the next four weeks:
- 7) How much control do you believe you have over **engaging in the recommended levels of physical activity per day** over the next four weeks
(No Control - Complete control)
- 8) Engaging in **the recommended levels of physical activity per day** over the next four weeks would be: (Worthwhile-Worthless;
- 9) Not enjoyable-Enjoyable;
- 10) Important-Unimportant
- 11) Unpleasant-Pleasant)
- 12) Most people important to me think that: (I should-I should not) engage in **the recommended levels of physical activity per day**
- 13) I think that most people who are important to me do **the recommended levels of physical activity per day**
- 14) I would prioritise engaging in **the recommended levels of physical activity per day** over other goals important to me over the next four weeks
- 15) Is engaging in **physical activity** something that you do at the same times and in the same places each time? (Definitely No – Definitely Yes).

The next set of questions relate to dental flossing. Regularly using dental floss to dislodge trapped food and plaque between your teeth can reduce gum disease as it also removes plaque along the gum line. This is an important part of dental hygiene and it is recommended that you **floss at least once per day** before brushing.

- 1) I am likely to **floss once per day** over the next four weeks:
- 2) I intend to **floss once per day** over the next four weeks:
- 3) I want to **floss once per day** over the next four weeks
- 4) I feel I should **floss once per day** over the next four weeks
- 5) On how many days would you expect to **floss** over the next four weeks?
- 6) If it were entirely up to me, I am confident that I could **floss once per day** over the next four weeks:
- 7) How much control do you believe you have over **flossing once per day** over the next four weeks (No control - Complete control)
- 8) **Flossing once per day** over the next four weeks would be: (Worthwhile-Worthless;

- 9) Not enjoyable-Enjoyable;
- 10) Important-Unimportant
- 11) Unpleasant-Pleasant)
- 12) Most people important to me think that: (I should-I should not) **floss once per day**
- 13) I think that most people who are important to me **floss once per day**.
- 14) I would prioritise **flossing once per day** over other goals important to me:
- 15) Is **flossing** something that you do at the same times and in the same places each time? (Definitely No – Definitely Yes).

The next set of questions relate to not exceeding the recommended levels of alcohol per day. Current drinking recommendations in the UK advise men and women not to regularly drink more than 14 units of alcohol a week, and to spread drinking over three days or more. Fourteen units is equivalent to six pints of average strength beer or 10 small glasses of low strength wine. The recommendations are equivalent to **not drinking more than 2 units of alcohol per day**.

- 1) I am likely to **avoid drinking more than 2 units of alcohol per day** over the next four weeks:
- 2) I intend to **avoid drinking more than 2 units of alcohol per day** over the next four weeks:
- 3) I want to **avoid drinking more than 2 units of alcohol per day** over the next four weeks
- 4) I feel I should **avoid drinking more than 2 units of alcohol per day** over the next four weeks
- 5) How many **units of alcohol** would you expect to consume per day over the next four weeks? ____ units
- 6) If it were entirely up to me, I am confident that I could **avoid drinking more than 2 units of alcohol per day** over the next four weeks:
- 7) How much control do you believe you have over **avoiding drinking more than 2 units of alcohol per day** over the next four weeks (No control – Total control)
- 8) **Avoiding drinking more than 2 units of alcohol per day** over the next four weeks would be: (Worthwhile-Worthless;
- 9) Not enjoyable-Enjoyable;

- 10) Important-Unimportant;
- 11) Unpleasant-Pleasant)
- 12) Most people important to me think that: (I should-I should not) **avoid drinking more than 2 units of alcohol per day.**
- 13) I think that most people who are important to me **avoid drinking more than 2 units of alcohol per day**
- 14) I would prioritise **avoiding drinking more than 2 units of alcohol per day** over other goals important to me over the next four weeks
- 15) Is **drinking alcohol** something that you would do at the same times and in the same places each time? (Definitely No – Definitely Yes).

Recent recommendations regarding sedentary behaviour suggest that there are a range of negative health effects produced by spending long periods of time sitting. The questions below relate to **avoiding being sedentary each day** - by this we mean sitting for over 30 minutes at a time. This includes sitting continuously when: 1) traveling to and from places, 2) at work, 3) watching television, 4) using a computer at home, and 5) for other leisure activities.

- 1) I am likely to **avoid being sedentary each day** over the next four weeks:
- 2) I intend to **avoid being sedentary each day** over the next four weeks
- 3) I want to **avoid being sedentary each day** over the next four weeks
- 4) I feel I should **avoid being sedentary each day** over the next four weeks
- 5) How many hours/minutes do you expect to spend per day **continuously sitting for over half an hour at a time** over the next four weeks? ___hours
___minutes
- 6) If it were entirely up to me, I am confident that I could **avoid being sedentary each day** over the next four weeks
- 7) How much control do you believe you have over **avoiding being sedentary each day** over the next four weeks (No control – Total control)
- 8) **Avoiding being sedentary each day** over the next four weeks would be:
(Worthwhile-Worthless;
- 9) Not enjoyable-Enjoyable;
- 10) Important-Unimportant;
- 11) Unpleasant-Pleasant)

- 12) Most people important to me think that: (I should-I should not) **avoid being sedentary each day** over the next four weeks
- 13) I think that most people who are important to me **avoid being sedentary each day**.
- 14) I would prioritize **avoiding being sedentary each day** over other goals important to me (Strongly disagree- strongly agree)
- 15) Is **being sedentary** something that you do at the same times and in the same places each time? (Definitely No – Definitely Yes).

The next set of questions will relate to eating unhealthy snacks between meals.

Unhealthy snacks are those that are high in sugar (e.g. soft drinks & energy drinks), high in fat (e.g. fried foods such as chips/crisps) or high in both fat and sugar (e.g. cakes, doughnuts). It is recommended that you **avoid eating unhealthy snacks each day**.

- 1) I am likely to **avoid eating unhealthy snacks each day** over the next four weeks:
- 2) I intend to **avoid eating unhealthy snacks each day** over the next four weeks:
- 3) I want to **avoid eating unhealthy snacks each day** over the next four weeks
- 4) I feel I should **avoid eating unhealthy snacks each day** over the next four weeks
- 5) How many **unhealthy snacks** would you expect to consume per day over the next four weeks?
- 6) If it were entirely up to me, I am confident that I could **avoid eating unhealthy snacks each day** over the next four weeks:
- 7) How much control do you believe you have over **avoiding eating unhealthy snacks each day** over the next four weeks (No control – Total control)
- 8) **Avoiding eating unhealthy snacks each day** over the next four weeks would be: (Worthwhile-Worthwhile;
- 9) Not enjoyable-Enjoyable;
- 10) Important-Unimportant;
- 11) Unpleasant-Pleasant)
- 12) Most people important to me think that: (I should-I should not) **avoid eating unhealthy snacks each day** over the next four weeks

- 13) I think that most people who are important to me **avoid eating unhealthy snacks each day**.
- 14) I would prioritize **avoiding eating unhealthy snacks** over other goals important to me (Strongly disagree- strongly agree)
- 15) Is **eating unhealthy snacks** something that you do at the same times and in the same places each time? (Definitely No – Definitely Yes).

Past behaviour items

The next set of questions will relate to your behaviour over the past four weeks.

- 1) How often do you eat five portions of fruit or vegetables per day? (Never, rarely, sometimes, often, always).
- 2) Eating five portions of fruit and vegetables a day is something I do automatically (strongly disagree – strongly agree)
- 3) Eating five fruit and vegetables a day is not something I do or plan to do: (strongly disagree – strongly agree)
- 4) How often do you engage in the daily recommended levels of physical activity? (Never, rarely, sometimes, often, always).
- 5) Engaging in the daily recommended levels of physical activity is something I do automatically (strongly disagree – strongly agree)
- 6) Engaging in the daily recommended levels of physical activity is not something I do or plan to do: (strongly disagree – strongly agree)
- 7) How often do you floss once per day? (Never, rarely, sometimes, often, always).
- 8) Flossing once per day is something I do automatically (strongly disagree – strongly agree)
- 9) Flossing once a day is not something I do or plan to do:
- 10) How often do you avoid drinking more than 2 units of alcohol per day? (Never, rarely, sometimes, often, always).
- 11) Avoiding drinking more than 2 units of alcohol per day is something I do automatically (strongly disagree – strongly agree)
- 12) Avoiding drinking more than 2 units of alcohol per day is not something I do or plan to do: (strongly disagree – strongly agree)
- 13) How often do you avoid being sedentary each day? (Never, rarely, sometimes, often, always).

- 14) Avoiding being sedentary each day is something I do automatically (strongly disagree – strongly agree)
- 15) Avoiding being sedentary each day is not something I have done or plan to do: (strongly disagree – strongly agree)
- 16) How often do you avoid eating unhealthy snacks each day? (Never, rarely, sometimes, often, always).
- 17) Avoiding eating unhealthy snacks each day is something I do automatically (strongly disagree – strongly agree)
- 18) Avoiding eating unhealthy snacks each day is not something I do or plan to do: (strongly disagree – strongly agree)

Additional dissonance items

We want to know how much the answers you gave on the survey represent your real views or were the answers that you thought you should give. It is not a problem if your answers were not your true opinions - we simply need to know if that was the case.

Please be honest in answering these questions!

- 1) I gave answers to the survey questions that I thought I should give, rather than what I really believe about... (Definitely No- Definitely Yes)
- 2) The answers that I have given to the survey questions were more positive than my real views about... (Definitely No – Definitely Yes).

Follow up items

Health behaviours

1. How often do you eat at least five portions of fruit or vegetables each day? (Never, rarely, sometimes, often, always).
2. On how many days did you eat 5 portions of fruit and vegetables over the past four weeks?
3. Over the past four weeks I ate at least 5 portions of fruit and vegetables per day (strongly disagree – strongly agree).
4. How often do you engage in at least the recommended levels of physical activity? (Never, rarely, sometimes, often, always).
5. On how many days did you engage in the recommended level of physical activity over the past four weeks?

6. Over the past four weeks I performed at least the recommended levels of physical activity per week (strongly disagree – strongly agree).
7. How often do you floss at least once per day? (Never, rarely, sometimes, often, always).
8. On how many days did you floss at least once during the average week over the past four weeks?
9. Over the past four weeks I flossed at least once per day (strongly disagree – strongly agree).
10. How often do you exceed the recommended daily maximum units of alcohol? (Never, rarely, sometimes, often, always).
11. Over the past four weeks how many days did you exceed the recommended weekly maximum units of alcohol?
12. Over the past four weeks I avoided exceeding the recommended daily maximum units of alcohol (strongly disagree – strongly agree).
13. How frequently are you sedentary (spending over 30 minutes continuously sitting)? (Never, rarely, sometimes, often, always).
14. On how many days did you avoid being sedentary over the past four weeks?
15. Over the past four weeks I have managed to avoid being sedentary each day (strongly disagree – strongly agree).
16. How often do you consume unhealthy snacks? (Never, rarely, sometimes, often, always).
17. On how many days over the past four weeks did you consume unhealthy snacks?
18. Over the past four weeks I managed to avoid consuming unhealthy snacks (strongly disagree – strongly agree).

Intention items

- 1) I intend to **eat at least five fruit and vegetables a day** over the next four weeks
- 2) I intend to engage in **the recommended levels of physical activity per day** over the next four weeks:
- 3) I intend to **floss at least once per day** over the next four weeks:
- 4) I intend to **avoid drinking more than 2 units of alcohol per day** over the next four weeks:
- 5) I intend to **avoid being sedentary each day** over the next four weeks

- 6) I intend to **avoid eating unhealthy snacks each day** over the next four weeks:

Purchasing behaviours

- 1) How often do you purchase groceries? (Never, rarely, sometimes, often, always).
- 2) How many times did you purchase groceries over the past four weeks?
- 3) Compared to an average month I purchased groceries more than usual over the past four weeks (Strongly disagree-Strongly agree)
- 4) How often do you purchase toiletries and/or cosmetics? (Never, rarely, sometimes, often, always).
- 5) How many times did you purchase toiletries and/or cosmetics over the past four weeks?
- 6) Compared to an average month I purchased toiletries and/or cosmetics more than usual over the past four weeks (Strongly disagree-Strongly agree)
- 7) How often do you purchase household cleaning products? (Never, rarely, sometimes, often, always)
- 8) How many times did you purchase household cleaning products over the past four weeks?
- 9) Compared to an average month I purchased household cleaning products more than usual over the past four weeks (Strongly disagree-Strongly agree)
- 10) How often do you purchase clothing? (Never, rarely, sometimes, often, always).
- 11) Over the past four weeks how many times did you purchase clothing?
- 12) Compared to an average month I purchased clothing more than usual over the past four weeks (Strongly disagree-Strongly agree)
- 13) How often do you purchase music (including digital downloads) (Never, rarely, sometimes, often, always).
- 14) How many times did you purchase music (including digital downloads) over the past four weeks?
- 15) Compared to an average month I purchased music (including digital downloads) more than usual over the past four weeks (Strongly disagree-Strongly agree)
- 16) How often do you spend money on non-essentials? (Never, rarely, sometimes, often, always).
- 17) How much did you spend on non-essentials (e.g. not including rent, bills etc.) over the past four weeks?

- 18) Compared to an average month I spent more on non-essentials than usual over the past four weeks (Strongly disagree-Strongly agree)

Purchasing intention items

- 1) I intend to **purchase groceries** over the next four weeks
- 2) I intend to **avoid purchasing clothing** over the next four weeks
- 3) I intend to **purchase toiletries and/or cosmetics** over the next four weeks
- 4) I intend to **avoid purchasing music (including digital downloads)** over the next four weeks
- 5) I intend to **purchase household cleaning products** over the next four weeks
- 6) I intend to **avoid spending money on non-essentials** over the next four weeks.

Self-monitoring items (1-5 item scale always false-always true)

- 1) In social situations, I have the ability to alter my behaviour if I feel that something else is called for.
- 2) I have the ability to control the way I come across to people, depending on the impression I wish to give them.
- 3) When I feel that the image I am portraying isn't working, I can readily change it to something that does.
- *4) I have trouble changing my behaviour to suit different people and different situations.
- 5) I have found that I can adjust my behaviour to meet the requirements of any situation I find myself in.
- *6) Even when it might be to my advantage, I have difficulty putting up a good front.
- 7) Once I know what the situation calls for, it's easy for me to regulate my actions accordingly
- 8) I am often able to read people's true emotions correctly through their eyes.
- 9) In conversations, I am sensitive to even the slightest change in the facial expression of the person I'm conversing with.
- 10) My powers of intuition are quite good when it comes to understanding others' emotions and motives.

- 11) I can usually tell when others consider a joke to be in bad taste, even though they may laugh convincingly.
- 12) I can usually tell when I've said something inappropriate by reading it in the listener's eyes.
- 13) If someone is lying to me, I usually know it at once from that person's manner of expression.

Conscientiousness items (1 strongly disagree – 7 strongly agree)

- 1) I am always prepared.
- 2) I pay attention to details.
- 3) I get chores done right away.
- 4) I like order.
- 5) I follow a schedule.
- 6) I am exacting in my work
- 7) I leave my belongings around.
- 8) I make a mess of things.
- 9) I often forget to put things back in their proper place.
- 10) I shirk my duties.

Life domains measure

The following question is about issues and topics that often occupy people's minds – things that they may think about during their daily lives and things they may do something about. For example you may think about your health and do something about it by working to behave in a healthy way or working to stay healthy.

You will now be asked to indicate to what extent the following topics influence your daily thoughts and activities. Please rate from 0 – 6 how much you think about and plan to do something about each of the topics where 0 indicates you do not think about or plan to do anything about it and 6 indicates that you think a lot about it and do a lot about it.

A: Health

B: Harmony, serenity

- C: Wisdom, a mature understanding of life
- D: Pleasure, fun, enjoyment
- E: Self respect, positive self image
- F: Social standing, social recognition
- G: Job aptitude, success in career
- H: Self-assertion, ability to get things done
- I: Harmonious relationship
- J: Excitement, adventure
- K: Compassion, ability to empathise
- L: Independence, personal freedom
- M: Security of family, care for family members
- N: Affluence, high standard of living
- O: Mental fitness
- P: Intimacy, sexuality
- Q: Personal development, reaching my full potential
- R: Physical performance, fitness
- S: Satisfying friendships, social integration
- T: Commitment to social ideals
- U: Faith, inner peace, redemption.

Appendix B5. Study 5 materials.

Control questionnaire

1) My intention to use the internet to find things out is

1 2 3 4 5 6 7

Not at all strong

Strong

2) I plan to use the internet on a daily basis to find things out in the next few weeks

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

3) I want to use the internet to find things out in the next few weeks

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

4) For me, using the internet to find things out in the next few weeks would be . . .

1 2 3 4 5 6 7

Not enjoyable

Enjoyable

Bad

Good

Harmful

Beneficial

Not Worthwhile

Worthwhile

'Doing' healthy snacking questions

1) My intention to eat healthy snacks in the next few weeks is...

1 2 3 4 5 6 7

Not at all strong

Strong

2) I plan to eat healthy snacks in the next few weeks

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

3) I want to eat healthy snacks in the next few weeks

1	2	3	4	5	6	7
Strongly disagree				Strongly agree		

4) For me, eating healthy snacks in the next few weeks would be . . .

1	2	3	4	5	6	7
Not enjoyable				Enjoyable		
Bad				Good		
Harmful				Beneficial		
Not Worthwhile				Worthwhile		

‘Not doing’ healthy snacking questions

1) My intention to not eat healthy snacks in the next few weeks is...

1	2	3	4	5	6	7
Not at all strong					Strong	

2) I plan to not eat healthy snacks in the next few weeks

1	2	3	4	5	6	7
Strongly disagree				Strongly agree		

3) I want to not eat healthy snacks in the next few weeks

1	2	3	4	5	6	7
Strongly disagree				Strongly agree		

4) For me, not eating healthy snacks in the next few weeks would be . . .

1	2	3	4	5	6	7
Not enjoyable				Enjoyable		
Bad				Good		
Harmful				Beneficial		
Not Worthwhile				Worthwhile		

Appendix B6: Study 6 materials

'Doing' healthy snacking questions

1) In the next week I predict that I will eat healthy snacks

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

2) My intention to eat healthy snacks in the next week is...

1 2 3 4 5 6 7

Very weak

Very strong

3) I will try to eat healthy snacks in the next week

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

4) I want to eat healthy snacks in the next week

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

5) I expect to eat healthy snacks in the next week.

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

6) For me, eating healthy snacks in the next week would be...

1 2 3 4 5 6 7

Not enjoyable

Enjoyable

7) For me, eating healthy snacks in the next week would be...

1 2 3 4 5 6 7

Bad

Good

8) For me, eating healthy snacks in the next week would be...

1 2 3 4 5 6 7

Not enjoyable

Enjoyable

7) For me, using the internet in the next week would be...

1 2 3 4 5 6 7

Bad

Good

8) For me, using the internet in the next week would be...

1 2 3 4 5 6 7

Harmful

Beneficial

9) For me, using the internet in the next week would be...

1 2 3 4 5 6 7

Not Worthwhile

Worthwhile

Appendix B7: Study 7 Materials

'Not doing' unhealthy snacking questions

1) In the next week I predict that I will not eat unhealthy snacks

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

2) My intention not to eat unhealthy snacks in the next week is...

1 2 3 4 5 6 7

Very weak

Very strong

3) I will try not to eat unhealthy snacks in the next week

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

4) I don't want to eat unhealthy snacks in the next week

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

5) I expect not to eat unhealthy snacks in the next week.

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

6) For me, not eating unhealthy snacks in the next week would be...

1 2 3 4 5 6 7

Not enjoyable

Enjoyable

7) For me, not eating unhealthy snacks in the next week would be...

1 2 3 4 5 6 7

Bad

Good

8) For me, not eating unhealthy snacks in the next week would be...

1 2 3 4 5 6 7

Harmful

Beneficial

9) For me, not eating unhealthy snacks in the next week would be...

1 2 3 4 5 6 7

Not Worthwhile

Worthwhile

Control questionnaire

1) In the next week I predict that I will use the internet

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

2) My intention to use the internet in the next week is...

1 2 3 4 5 6 7

Very weak

Very strong

3) I will try to use the internet in the next week

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

4) I want to use the internet in the next week

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

5) I expect to use the internet in the next week.

1 2 3 4 5 6 7

Strongly disagree

Strongly agree

6) For me, using the internet in the next week would be...

1 2 3 4 5 6 7

Not enjoyable

Enjoyable

7) For me, using the internet in the next week would be...

1 2 3 4 5 6 7

Bad

Good

8) For me, using the internet in the next week would be...

1 2 3 4 5 6 7

Harmful

Beneficial

9) For me, using the internet in the next week would be...

1 2 3 4 5 6 7

Not Worthwhile

Worthwhile

Appendix C: Additional analyses not reported in the main text

Table C1. *Descriptive statistics of attitude measures across studies.*

Attitude	Study	Behaviour	Mean	SD
Not enjoyable- Enjoyable	2	(doing) Unhealthy snacking	3.69	1.03
	3	Alcohol	2.47	.87
	3	Smoking	2.68	1.27
	4	Unhealthy Snacking	3.53	1.91
	4	Alcohol	4.75	1.91
	5-6	Healthy snacking	4.99	1.62
	6-7	Unhealthy snacking	3.78	1.82
Bad-Good	2	Unhealthy snacking	2.59	1.23
	3	Alcohol	3.76	.93
	3	Smoking	4.39	.892
		Healthy snacking	6.08	1.26
		Unhealthy snacking	5.67	1.37
Harmful- Beneficial	2	Unhealthy snacking	2.09	.93
	3	Alcohol	4.25	.79
	3	Smoking	4.60	.71
	5-6	Healthy snacking	6.67	0.53
	6-7	Unhealthy snacking	6.19	1.06
Not Worthwhile- Worthwhile	2	Unhealthy snacking	2.54	1.15
	3	Alcohol	3.36	1.16
	3	Smoking	4.13	1.19
	4	Snacking	5.91	1.56

Attitude	Study	Behaviour	Mean	SD
	4	Drinking	5.70	1.78
	5-6	Healthy snacking	6.17	1.07
	6-7	Unhealthy snacking	5.38	1.66
Unimportant- Important	4	Snacking	5.69	1.52
	4	Alcohol	5.23	1.92
Unpleasant- Pleasant	4	Snacking	3.83	1.75
	4	Alcohol	4.99	1.74

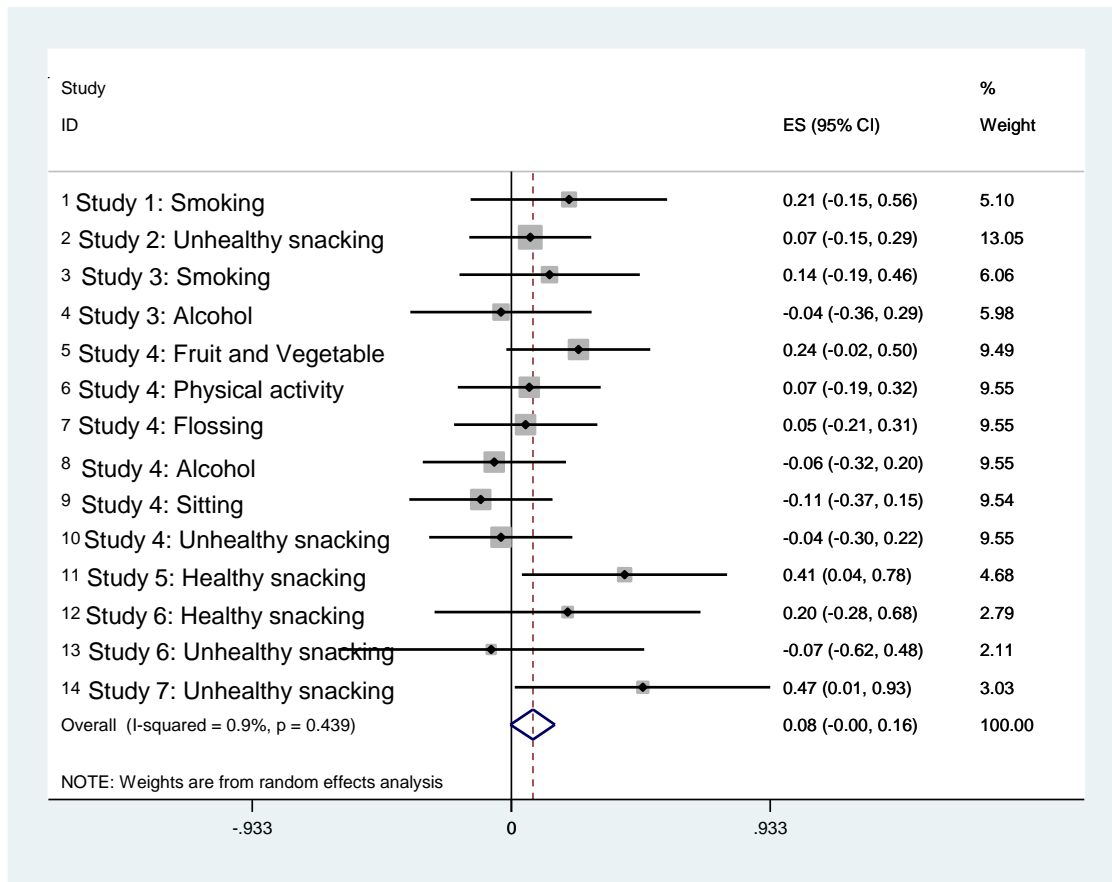


Figure C1. Forest plot of mini-meta analysis of studies presented in this thesis.