London School of Economics and Political Science

The impact of patient financial incentives to promote blood donation and compliance with health care

Claudia Fernandes Niza

A thesis submitted to the Department of Social Policy at the London School of Economics for the degree of Doctor of Philosophy, London, June 2014

Declaration of Authorship

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

This thesis was funded by a Strategic Award from the Wellcome Trust Biomedical Ethics Programme (PI Marteau: 086031/Z/08/Z) and developed as part of the Centre for the Study of Incentives in Health at King's College London (KCL). Although this funding determined the study of financial incentives in health as the core subject of my thesis, I independently defined the theoretical and methodological approaches to this topic.

I declare that my thesis consists of 58,966 words.

Statement of conjoint work

A shorter version of Chapter 4 – the systematic review and meta-analysis about the impact of financial incentives in blood donation – has been published and is co-authored with Theresa Marteau and Burcu Tung, both at KCL when the work was produced. I am first author of this paper and contributed 70% of the work – remaining co-authors contributed 20% and 10% respectively. This work benefited from an additional grant from the Nuffield Council of Bioethics to inform the report: Human Bodies: Donation for Medicine and Research http://www.nuffieldbioethics.org.

The work on Chapter 5 – a cluster randomized controlled trial testing financial incentives to increase Chlamydia screening – has also been accepted for publication and is co-authored with Paul Dolan and Caroline Rudisill. I am first author of the paper and contributed 60% of the work – remaining co-authors 20% each.

Abstract

The purpose of this thesis is to examine the impact of financial incentives to promote health behaviour change. Financial incentives include tangible rewards as cash, vouchers and lotteries that are offered to individuals conditional to the fulfilment of health guidelines. Despite the growing use of such patient incentives in practice, some fundamental questions are yet to be answered: (1) Are financial incentives effective? (2) What type and size of incentive is more effective? (3) Do patient income and past health behaviour moderate the impact of incentives? These questions are analysed in the context of (a) blood donation and (b) compliance with health care including adherence to treatment, disease screening, immunisation and appointment keeping. Behavioural economics, in particular prospect theory, provide the theoretical foundations for this work and substantiate my hypotheses about the effect of financial incentives.

I perform the first meta-analyses in the literature to quantify the impact of patient financial incentives to promote blood donation (chapter 3) and compliance (chapter 4). These results show that financial incentives do not promote blood donation but increase compliance with health care, particularly for low income patients.

Two large field studies were developed to further examine the effect of incentives in compliance - testing pioneer incentive schemes. I test the impact of a certain (£5 voucher) versus uncertain (£200 lottery) incentive framed either as a gain or loss to promote Chlamydia screening (chapter 5). I also develop the first study ever testing preferences for sequences of events in the field – using the naturalistic setting of colorectal cancer. This study compared the effect of a €10 incentive offered at the end of screening versus two €5 incentives offered at the beginning and end of screening (chapter 6). The former showed the voucher framed as a gain was the most effective incentive and the latter showed that smaller two €5 incentives increase screening more than a single €10 incentive (which had a detrimental effect compared to no incentive).

I fundamentally contribute to the literature by showing that (i) patient financial incentives do not increase the quantity of blood donations and may have an adverse effect on quality, providing empirical evidence to a long-standing policy debate. Furthermore (ii) small certain rewards around £5 are likely to be the optimal incentive for compliance with health care, (iii) higher incentives may be more effective if offered as smaller segregated incentives of the same amount and (iv) incentives have over twice the impact on low income patients than on more affluent patients.

Table of Contents

List of Figures

List of Tables

Acknowledgements

I would like to thank Paul Dolan and Carolina Rudisill for their guidance and advice in the preparation of this thesis and the freedom I had to manage my work.

I would like to acknowledge the funding for my doctoral studies by the Wellcome Trust as part of the Centre for the Study of Incentives in Health at King's College (CSI Health). I am in debt to the Centre coordinator Theresa Marteau (University of Cambridge) for having selected me for this project and to Morag McGuire, our great Centre Administrator. Without them, this thesis would not have reached its destination.

My appreciation also goes to my other colleagues at CSI Health for valuable comments throughout the years: Richard Ashcroft (Queen Mary's University), Matteo Gallizzi (LSE), Marianne Promberger (KCL), Florian Vogt (KCL) and particularly Eleni Mantzari (KCL) and Rebecca Brown (Queen Mary's University).

For support at earlier stages in the LSE, I would like to thank Adam Oliver, Barbara Fasolo, Elena Reutskaja (IESE Business School) and Daniel Read (Warwick Business School).

For the final stages of this work, I would like to express my gratitude to my colleagues at Catolica-Lisbon: Miguel Gouveia, David Patient, Irina Cojuharenco, Fernando Machado and Pedro Raposo.

To Luisa Lima and Silvia Silva at ISCTE Lisbon University Institute, for providing my first opportunity to work as research assistant, almost 10 years ago. Their guidance significantly contributed to developing the researcher I am today.

To Jose Pereirinha, Francisco Nunes, João Graça, João Lopes, Rafael Marques and more recently, Sofia Lourenço at ISEG, a school where doors have always been open for me.

To my dear friends, for their patience and understanding: Lisa, Ana Paula, Joana, Tatiana, JD, Inês, Salomé and Cátia.

Chapter 1

Introduction

Scholars and policy makers have long strived to understand the underpinnings of behaviour change (Shumaker et al, 2009). A long array of interventions to change health behaviour has been identified in the literature (Haynes et al, 2005; McDonald et al, 2002; Michie et al, 2008). Twenty-six types of interventions have been catalogued (Abraham & Michie, 2008) ranging from information, education, persuasion, coercion to complex multifactor environmental restructuring. Nonetheless, changing behavioural patterns - and particularly in the health domain - has proven to be a challenge. There is no conclusive evidence to support the application of a particular intervention to promote health behaviour and no single strategy has showed a clear comparative advantage across different health contexts (Michie et al, 2011; Haynes et al, 2005).

Furthermore, interventions do not necessarily target the factors that have been acknowledged as barriers to health behaviour and are seldom theoretically grounded (Michie & Abraham, 2004; Michie & Prestwich, 2010; Bartholomew & Mullen, 2011). The majority of interventions found in the public health literature are informational, aiming to promote health behaviour change through improved knowledge and attitude change (DiMatteo et al. 2012). But the effectiveness of this approach has been proved limited (Berben et al, 2011) as people don't always make decisions based on information (e.g., Ashraf et al, 2013). There is an increasing call for interventions that target health behaviour change directly, by tackling key motivational or contextual barriers (Schedlbauer et al, 2010; Michie & Johnson, 2012). Financial incentives are included in this category of interventions (Michie et al. 2008).

The purpose of this work is to examine the impact of patient financial incentives to promote health behaviour change. These *patient* financial incentives include tangible offers of cash, vouchers and gifts to be given to individuals upon the contingent fulfilment of health recommendations – individuals may not be 'patients' *per se* but this designation is intended to express a form of demand-side incentives explicitly and contingently offered to individuals.

Although the use of financial incentives is common in health settings, these patient incentives are distinct from previous applications of incentives in health. On the supply-

side of health care, physicians are often targeted with pay-for-performance schemes based on organisational and clinical outcomes (Gillam et al, 2012; Dushkeiko et al, 2006; Rodwin, 2004). Market-based reforms in several countries are increasing hospital competition by imposing conditional budget allocations based on past performance and acting as financial incentives (Eijkenaar et al, 2013). With respect to patient behaviour, the more traditional approach to changing behaviour using incentives has been through a change in prices. Higher taxes on tobacco and alcohol have been used to reduce consumption (Husten & Deyton, 2013) and fiscal food policies have been proposed to reduce unhealthy food intake (Mytton et al, 2007; Thow et al, 2010). In the past year Denmark has introduced a "fat tax," Hungary a "junk food tax," and France a tax on sweetened drinks (Mytton et al, 2012). On a different angle, reducing medical fees or increasing copayments in insurance plans are also commonly used to increase the uptake of GP visits or generics (Finkelstein et al, 2012; Rezayatmand et al, 2013).

The patient financial incentives analysed here are an alternative demand-side approach to changing individuals' health behaviour. Known as conditional cash transfers (CCT) in developing countries, such financial incentives have become a standard policy tool to promote the use of primary health care services, namely prenatal care, child immunization and HIV screening (Ranganathan & Lagarde, 2012; Kohler & Thornton, 2012). In higher income countries - including the UK - there has been a more widespread application of patient incentives in health care interventions. Incentives are offered not just to promote child immunization and prenatal care but also smoking cessation (Volpp et al. 2009), drug abstinence (Higgins et al. 2012), weight loss (John et al, 2011), appointment keeping (Post et al, 2006), cancer screening (Stone et al. 2002) and adherence to chronic disease medication (Claassen et al, 2007; Volpp et al. 2008).

Evaluation studies in developing countries have shown a significant positive impact of financial incentives in promoting child immunization and school enrolment (Gertler, 2004; Rawlings & Rubio, 2005; De Brauw & Hoddinott, 2011) and promoting HIV screening in adults (Thornton, 2008). However, the effectiveness of contingent financial incentives in developed countries is not yet clear. In developed countries, the significant effect of patient incentives has only been established to promote drug abstinence (Lussier et al, 2006). The effectiveness of these patient incentives in higher income countries is still being established for most other health contexts and fundamental questions still need to be answered (Ashcroft et al, 2008; Marteau et al, 2009), not only about overall effectiveness but also possible moderator effects of type of incentive and patient socioeconomic

characteristics. This work examines the effect of patient financial incentives strictly in developed countries, for which no comprehensive evaluation studies have yet been developed. These crucial questions will be addressed in this work using blood donation and compliance with health care as research contexts.

Financial incentives are one of several possible ways to think about health behaviour. The analysis of patient financial incentives as a strategy for health promotion does not neglect the myriad of personal and cultural barriers that influence health behaviour (Gerend et al, 2013) but may be successful at an aggregate level by increasing perceived immediate benefits and prompting individuals to engage in healthy behaviour (Milkman et al, 2012) – an intention reported by the vast majority of people (Wiedermann et al, 2009).

1.1 Theoretical Standpoint

Economic approaches to policymaking traditionally work under the assumption that individuals are rational agents with a stable and well-defined set of preferences from which they are capable to choose in ways that maximise their utility (Laffont & Martimort, 2009). Financial incentives are proposed under this assumption: the law of demand and the relative price effect work through the use of external incentives because motivation and preferences are taken to be fixed and given (Fehr & Falk, 2002; Kamenica, 2012). Economic theory derives its strength from predicting how people make cost-benefit calculations and change their behaviour in response to changes in incentives (Gneezy et al, 2011).

Although this framework has proved useful in many contexts, its assumptions may not always hold because people have limited cognitive abilities, are influenced by the context in which they make decisions, are driven by emotional reactions, and by the opinion of others (Bowles & Polania-Reyes, 2012; Gigerenzer & Gaissmeier, 2011; Kamenica, 2012). Poor compliance rates with health guidelines provide a good illustration of this standpoint (Rice, 2013): most individuals do not intentionally neglect medical advice but report memory lapses for health appointments, suspect medication side-effects or fear cancer screening (Weinstein & Klein, 1996; Phillips et al, 2001; Dunbar-Jacob et al, 2009). This means that financial incentives – as paradigmatic tools from standard economic theory – may not always work as expected by the rational choice model (Ariely et al, 2009).

Behavioural economics integrates psychological insights – mostly from cognitive psychology - into standard economic theory in an attempt to address some of the descriptive limitations (Kahneman & Trversky, 1979; Dolan et al, 2010; Dellavigna, 2009; Heap, 2013; Loewenstein et al, 2013). Standard economic theory is a broad normative model about decision-making whereas behavioural economics is typically associated with descriptive models of choice. Disputes over the contributions of normative versus descriptive models have eroded over time with many of the ideas from behavioural economics having already been long incorporated in standard economics (e.g., Hossain & List, 2012; Rabin, 2013a; Duflo et al, 2012). Behavioural economics aims to improve the psychological realism of standard economics but often maintaining conventional techniques and goals: formal theoretical and empirical analysis using tractable models, with a focus on prediction and estimation (Rabin, 2013b). It can, in some cases, provide more an incremental change to standard economics than a paradigmatic change. Increasingly more, the standpoint in the literature is not competition between these approaches but contingency and cooperation (Harrison & Rutstrom, 2009). Considering the specific case of this work: if financial incentives are proven effective to promote health behavior change, standard economics may fully explain the result. But if incentive size has a negative effect, behavioural economics may be better equipped to explain such a finding.

Behavioural economics assumes that financial incentives may be effective in changing behaviour – in agreement with standard economics in this point - but considers the importance of additional factors like the context in which incentives are offered, how incentives are framed, which type of incentive is offered or what is the delivery schedule of the incentive (Rice, 2013). Therefore, in addition to the general question if patient financial incentives work, I am interested in understanding if interventions grounded in behavioural research are more effective than standard applications of market incentives. Unlike previous incentive health interventions, which have been mostly atheoretical (Michie & Prestwich, 2010; Bartholomew & Mullen, 2011), the analysis and design of incentive schemes in this work will be informed by behavioural economics, particularly by prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992).

Prospect theory is a descriptive theory of choice that has been proven adequate to explain and predict systematic deviations from the rational choice model in several contexts including health (Winter & Parker, 2007; Abellan-Perpinan et al, 2008; Schwartz et al, 2008). Prospect theory is not specifically about financial incentives *per se* but it is about decision-making processes involving both risky (Kahneman & Tversky, 1979) and

riskless choices (Tversky & Kahneman, 1991) - which can be used to substantiate research about financial incentives. This theory models choice as a two-phase process: the first phase involves editing while the second involves evaluation. This two-process is one of the distinctive features of prospect theory and both stages have implications to this work. In the editing stage, people develop simpler representations of the choice elements, in which mental accounting is included. Mental accounting is related to the subjective mental arithmetic operations performed by people to evaluate financial prospects and this stage may have implications for how incentives are framed to people (e.g., as a potential gain or avoidance of loss; as one gain or two gains of equal amount) and which type of incentive is offered (i.e., different incentives are categorized in different 'mental boxes'). After the editing phase, individuals engage in the evaluation of the edited prospects and have been shown to (i) compare how expected outcomes depart from a reference point (typically current status quo), (ii) wanting more strongly to avoid a loss than to have a gain of equal value; and (iii) overweighting small probability outcomes. All these features have implications for the design of incentive schemes and will be extensively discussed in Chapter 2.

Taking a behavioural perspective to the analysis of economic forces does not undermine them or to suggest they are unimportant. The highly influential work of Thaler and Sunstein (2008) *Nudge* makes this point very clearly. The first letter N on NUDGES stands for iNcentives (Thaler & Sustein, 2008, p. 109). According to Thaler and Sunstein, financial incentives are powerful policy tools and the most important modifications that could be made to market price incentives are changes in salience and framing: sensible choice architects choose the right incentives for the right people in the right context (p.106). In this work, behavioural economics and particularly prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) will work as the road maps to attempt to achieve this.

The behavioural economics standpoint to behaviour change, essentially grounded in the 'nudge' approach can be considered a subset of the larger literature of behaviour modification (Michie et al, 2013). Nudge is a non-regulatory approach that attempts to motivate individual behaviour change through subtle alterations in the choice environments that people face (Oliver, 2013), including incentives, defaults, descriptive social norms, etc. The typology developed by Michie et al 2013 which lists and systematises the array of interventions in the literature used to promote behavioural change include these subtle

nudge interventions, albeit giving more emphasis on traditional deliberative approaches as information, education or counselling.

Nonetheless, a feature that is specific to the *nudge* literature is the acknowledgment of a paternalistic viewpoint to behaviour change, particularly in health domains, which is not explicit in the general behaviour modification literature. The nudge approach is paternalistic in the sense of wanting to make individuals alter their behaviours such that they would be better off, as judged by their own stated preferences (Oliver, 2013; Marteau et al, 2009). People are *nudged* to make voluntary decisions that, according to deliberative selves, they would like to make. This is the angle I take on my work.

An area in which behavioural economics differs from standard economic theory is the acknowledgement that incentives may decrease the likelihood of some behaviour occurring. Standard economics acknowledges that incentives may create unexpected effects such as externalities, but does not consider the possibility that incentives may be counterproductive in eliciting the incentivized behaviour. Titmuss's manifesto (1971) for altruistic blood donation marked the start of discussions about the perverse effects of incentivizing behaviour that became known as *motivational crowding-out*. Motivational crowding-out is the umbrella term used in economics for the reverse of the relative price effect in economic theory, i.e., when higher incentives lead to lower (not higher) supply or effort (Bénabou & Tirole, 2003; Frey & Oberholzer-Gee, 1997; Kreps, 1997). There has been much discussion but little agreement about the definition of motivational crowding-out; generally speaking, this concept is related to incentives being counterproductive if they affect individuals' perception of autonomy and self-determination (Frey & Oberholzer-Gee, 1997; Frey & Jegen, 2001; Kohn, 1993; Deci & Ryan, 1985, 2012).

Evidence for motivational crowding-out in economics is measured as the decrease in the incentivised behaviour once rewards are introduced (Gneezy et al. 2011; Kamenica, 2012). There is also a large literature in psychology about the undermining effect of rewards on intrinsic motivation, developed shortly after Titmuss (Deci, 1975). This tradition, however, analyzes motivational crowding-out once incentives are removed. This work does not provide any evidence on post-incentive periods and, therefore, I assess motivational crowding-out as defined in economic theory by considering negative behavioural effects in the presence of incentives. Although the expression is '*motivational*' crowding-out, there is no actual assessment of psychological motivational factors. Detrimental effects on motivation are inferred from behaviour.

Behavioural research has exposed situations in which incentives backfire but so far the evidence is mostly restricted to contexts where people want to behave altruistically, are engaged in enjoyable activities or want to fulfil their duty as citizens (Deci et al. 1999; Bowles et al, 2008; Mellström & Johannesson, 2008). The existing evidence does not provide clear guidelines for or against the use of incentives in health settings (Promberger & Marteau, 2013). This work will make an essential contribution to the literature by providing empirical data to test the hypothesis of crowding-out effects in health behaviour.

In addition to the importance of supporting the discussions about financial incentives in empirical data, one should also acknowledge the importance public acceptability of incentives when contemplating their use as a policy tool. Financial incentives are gaining momentum in the public arena and media (Brown & Promberger, 2011). The effectiveness of incentive schemes and their potential benefits and harms has been subject to passionate discussions (Jochelson, 2006). Moral and ethical objections to such schemes have been raised (Parke et al, 2011), based on arguments that portray incentives as a form a coercion or bribery to patients. Financial incentives have been judged as less acceptable and less fair than medical interventions to promote health behaviour (Promeber et al, 2011). Public health providers tend to express favourable views to patients incentives whereas opposition comes mostly from third sector organisations and the media (Parke et al, 2011). The general public, however, may be persuaded by an increased perception of effectiveness. Promberger and colleagues (2012) showed that the acceptability of financial incentives increased with effectiveness, particularly when incentives become more effective than alternative approaches. Even a small increase in effectiveness from 10% to 11% increased the proportion favouring incentives from 46% to 55%. If public acceptability is influenced by perception of effectiveness, a clear assessment of the impact of financial incentives may be a crucial contribution to a positive attitude change.

1.2 Research and Policy Contexts

The effect of patient financial incentives will be analysed in the contexts of blood donation and compliance with health care. The impact of incentives has not been established in either of these contexts and clarifying how incentives influence behaviour in both settings brings distinctive contributions to the literature.

In addition to the importance of understanding the role of incentives in each context per se, their comparative analysis makes an additional contribution. For blood donation,

incentives are offered in exchange for an action that strictly benefits the health of others. For compliance, incentives are offered for people to take care of their own health - which they should do regardless of the incentive. This raises the question about the relative effectiveness of financial incentives to trigger self-interest versus 'other-interest' behaviour. This distinction may have a significant impact in the likelihood to accept the incentive, which incentive is more effective or the incentive size that is needed to promote change.

1.2.1 Blood donation

I start by analysing the impact of incentives in blood donation given its core position in the literature on incentives in health and its high policy relevance (Busby et al, 2013; Roach, 2013). The influential book *'The Gift Relationship'* by Titmuss (1970) spurred the interest for unintended or counterproductive effects of financial incentives. Titmuss made the influential statement that a system based on voluntary blood donation would lead to better outcomes – higher blood quality supplied in a more efficient way – than a system paying for blood. However, Titmuss himself acknowledged the paucity of empirical data to test his assumptions. Arguments for and against the use of incentives to promote blood donation have been heavily debated in academia and the media over the years (e.g., Hartford, 2011) with economists by and large proposing opposing views to voluntary donations (Lacetera et al, 2013). Nevertheless, no clear attempts have been made to empirically settle this question.

Most of the current discussion about motivational crowding-out is still done in reference to Titmuss' work (Frey 1997; LeGrand, 2003; Promberger & Marteau, 2013). This has helped to maintain the payment for blood as highly controversial for decades. Scholars and policy makers emphasize the need to compromise in the implementation of acceptable and successful policies to increase blood supply – and implicitly assume incentives have to take some part of these policies (Ferguson et al, 2007; Lacetera et al, 2013). Moreover, nonfinancial incentives have been proposed as the best possibility to cut across the rigid dichotomy of altruistic donations versus payment for donations (Buyx, 2009; Sass, 2013). Given the key role of blood donation in the debate about the effectiveness of patient financial incentives, blood donation is the first context examined in this work.

Titmuss' work became the cornerstone for Governments and the World health Organisation (WHO hereafter) pleas of fully voluntary blood donation policies. The World

Health Assembly (WHA) passed the resolution WHA 28.72 in 1975 urging member states to develop blood systems based on voluntary non-remunerated donation of blood. In 1997, the WHO recommended that all blood donations should come from unpaid voluntary donors. However, by 2006, only 49 of 124 countries surveyed had established this as a standard. The WHO reiterated their position in 2009 with the Melbourne Declaration on 100% Voluntary Non-remunerated Donation of Blood and Blood Components with the statement that "*…paid donation can compromise the establishment of sustainable blood collection from voluntary non-remunerated blood donors*" (World Health Organization, 2009 p2).

In the United States, blood is donated through various organisations registered with the US Blood Bank including blood centres, the Red Cross and hospitals, with some providing financial incentives to encourage donation (Domen, 1995). In the UK, the blood supply is managed through NHS Blood and Transplant, with blood only taken from unpaid voluntary donors, although there is a donor award scheme that introduces various gifts with respect to the amount of blood being donated. Paid donors remain major blood suppliers in some European countries including Germany (Kretschmer et al, 2004). These examples reflect the diversity of policies across jurisdictions without a clear assessment that supports or refutes the use of financial incentives - in both the quantity and quality of the blood supplied.

1.2.2 Health care compliance

I will also analyse compliance with health care guidelines. This will include a set of behaviours (fully described below) with a significant impact in patient health and public expenditure (Neumman, 2012), providing a larger research context to examine several hypotheses about the effectiveness of incentives.

There is a considerable debate around the meaning of compliance (or adherence) to medical recommendations (Vrijens et al. 2012). The WHO defined adherence as the extent to which patients' behaviour corresponds to medical advice and recommended treatments (2003). A more recent review of the terminology used in the literature (Cramer et al. 2008) proposed compliance as a synonym to adherence, referring to the act of confirming to practitioners' health recommendations with respect to timing, dosage and frequency.

Medication noncompliance has traditionally been in the spotlight in the literature about health compliance behaviour with a large of number of studies focusing on barriers or determinants of medication compliance (Grosset et al, 2006; Sewitch et al, 2003; Horne,

2006; Schroeder et al, 2004). Noncompliance rates are reported to be significant, ranging from 30–70% for most chronic diseases, and overall, the WHO (2003) estimated that 50% of patients in developed countries do not adhere to medication as recommended.

However, although most research has focused on compliance to medication, health care compliance includes a variety of other health behaviours beyond taking prescribed drugs, regarding which there is also evidence of concerning low compliance. With respect to cancer screening, breast cancer traditionally has the highest uptake around 65%-80% but cervical screening has an average adherence of 50%-75% and colorectal cancer 40%-60% (NCPIE, 2007; NHS, 2003, 2006, 2008, 2009). Furthermore, people frequently miss medical appointments and do not always return for follow-ups to abnormal test results (Phillips et al, 2001; Osterberg & Blaschke, 2005). Compliance with health care guidelines has been shown to be particularly low in minority and ethnic groups (Dalton et al, 2011).

In this work, I will be particularly focusing on one-shot or short-term health behaviours: disease screening e.g., cancer screening, sexually transmitted infections (STI) screening, tuberculosis (TB) screening, adult and child immunisation, attending medical appointments are included under the umbrella of health care compliance. These behaviours share a common feature: there is an immediate present cost (e.g. waiting time, side-effects, anxiety with test results) to increase the likelihood of future benefits (e.g. better health, longer life expectancy). Smoking cessation, drug abstinence and exercise or healthy eating habits are also health recommendations but, in opposition, are more habitual and sustained behaviours which imply the withdrawal of immediate (often addictive) rewards to achieve future benefits. These lifestyle behaviour changes will not be included in the present work because the way in which patients respond to incentive in these contexts are likely to be different from one-shot or more time-limited situations (Garavan & Weierstall, 2012) and may not be directly comparable. Furthermore, research on financial incentives targeted more habitual behaviours like smoking cessation or exercise habits (e.g., Charness & Rabin, 2009) and more research is needed about one-shot or short-term health behaviours.

Patients' failure to adhere to medical advice is a major limiting factor in achieving therapeutic goals (Haskard et al, 2009) and is considered a critical health problem (WHO, 2003). Noncompliance significantly decreases health treatment outcomes (DiMatteo et al, 2002), is associated with higher mortality (Simpson et al, 2006; Rasmussen et al, 2007) and increases overall health expenditure (Bouchery et al, 2011; Finkelstein et al, 2009; Sokol et al, 2005; Horne, 2006). At a social level, there are negative externalities related to both noncompliance with treatment for infectious diseases and increased inequity

(Braveman & Gruskin, 2003) because economic deprivation is strongly related to poor health care compliance (Ashton et al, 2003; Dixon et al, 2007).

Numerous barriers to compliance have been identified and the literature on the determinants of noncompliance is abundant. However, evidence on interventions to promote compliance is far more limited (European Union ABC Project, 2012) and financial incentives have been increasingly proposed as a possible intervention (Marteau et al, 2011; Jochelson, 2007; Sutherland et al, 2008). I will contribute to the literature by evaluating the effectiveness of financial incentives as a tool to promote compliance with health care guidelines.

1.3 Methodological Options and Research Questions

This work poses three main research questions to be answered in two systematic reviews and meta-analyses, and two large field studies. Prospect theory is the overarching framework used as the main theoretical foundation for this work, particularly relevant for the design and evaluation of incentives schemes. However, its contribution is predominantly centred on research Question 2, even though prospect theory is a solid point of reference throughout all research questions.

Experimental studies in the lab are a sound methodological option to establish causal links and could have been used to elicit preferences for different incentives or to establish the effect of incentive size in hypothetical choice scenarios. However, this work is focused on understanding the behavioural effects *stricto sensu* of offering financial incentives to individuals for two main reasons. Firstly, there is evidence that stated versus revealed preferences may differ and the choices made in the lab even under incentive compatible scenarios may not predict behavioural patterns in natural settings (List & Gallet, 2001; Murphy et al, 2005). Secondly and directly related to this first reason, results from this work can potentially have significant implications for policy and population-level health interventions, which cautiously call for field testing (Harrison & List, 2004; Levitt & List, 2007, 2009). Therefore, this work is restricted to experimental field studies (i.e., evidence from naturally occurring settings from which causal links can be drawn) both for primary data collection (Chapter 5 and 6) and secondary data analyses in meta-analysis (Chapter 3 and 4).

Meta-analysis of randomised trials is based on the assumption that each trial provides an unbiased estimate of the effect of an experimental treatment, with the

variability of the results between the studies being attributed to random variation (Egger et al, 1998; Sterne, 2009). The overall effect calculated from a set of similar and logically combined randomised trials is expected to provide an unbiased effect size estimate. The case of observational studies is fundamentally different because such studies are prone to the effects of confounding factors (e.g., unobserved confounding factors that cannot be measured with sufficient precision, which often occurs in epidemiological studies) or the influence of biases (e.g., selection biases in case-control studies)." Regression analyses can control the effect of confounding factors and covariates but meta-analysis is based on raw unadjusted data. For these reasons, the two meta-analyses are exclusively based on experimental studies.

1.3.1 Research Question 1

Are financial incentives effective?

In the case of blood donation, to date there are only narrative reviews in the literature trying to answer this question. Two previous reviews have considered the impact of incentives on the likelihood of giving blood (Godin et al, 2012; Goette et al, 2010). One is an unsystematic review of the literature that mixes observational and experimental studies (Goette et al., 2010), in which the authors to conclude that incentives are effective to increase blood donation. The other review includes a wide variety of interventions (and not just incentives) to promote blood donation and report that there is insufficient evidence from incentive studies to draw any conclusion (Godin et al., 2012). A recent newsworthy piece of opinion in Science by Lacetera and colleagues (2013) makes a public endorsement for the use of financial incentives. However, this support is based on the authors' personal appraisal of past research. Given the absence of a systematic quantitative assessment of the literature on this topic, I will perform a systematic review and meta-analysis of randomised controlled trials regarding the impact of incentives in the quantity and quality of blood donated (chapter 3).

Concerning compliance, the pressing question is whether financial incentives actually work in developed countries because their positive impact has been shown in developing countries (De Brauw & Hoddinott, 2011). In higher income countries, several systematic reviews have been performed on the impact of incentives in different health contexts (Giuffrida & Torgerson, 1997; Kane et al, 2004; Jochelson, 2007; Sutherland et al, 2008) but this work has mostly been delivered in the form of narrative reviews, which do not provide any estimation of effect size. Kane and colleagues (2004) concluded that

incentives are effective to change 'simple' behaviours like attending medical appointments or immunisation but to a lesser extent more 'complex' life-style behaviours such as increasing exercise frequency, smoking cessation or drug abstinence.

However, these results were based on a simple frequency analysis. The only meta-analysis with a pooled estimate was performed in the area of drug abstinence with clinical patients (Lussier et al, 2006), reporting a strong positive effect. Yet this evidence is still not conclusive to inform if financial incentives are effective for the general (nonclinical i.e., with no diagnosed addiction condition) population or across a wider range of health behaviours. I will provide evidence to answer this question in the meta-analysis about compliance (chapter 4) and two field studies (chapter 5 and 6), the first related to Chlamydia screening and the second about colorectal cancer screening.

For both contexts the analysis is based on what happens when incentives are offered to patients and as such, this work does not include data on post-incentive periods. The analysis of possible motivational crowding-out effects is part of this research question but restricted to happens to behaviour once incentive are introduced – in line with the tradition in economic research. Although blood donation and compliance with health care tend to be one-shot or occasional behaviours, they can be recurrent (e.g., annual) and thus it is still relevant to understand what is the effect of incentives on these behaviours over time. However, this is currently not the focus of this work, strictly examining short-term effects. The long-term effects of offering financial incentives in these health contexts were not included as a research question.

I will bring timely and fundamental empirical evidence to the literature on crowding-out effects, which is mostly characterized by policy discussions and media debates without a clear empirical support.

1.3.2 Research Question 2

Which sort of incentive is more effective?

In addition to showing if patient financial incentives work, it is also important to determine which sort of incentive is more likely to be effective in promoting behaviour change. This question includes both type and size of incentive. There is a wide variety of incentives offered in health interventions, some of which can be designated as cash-based (cash, cheques, lotteries for money) and others defined as goods-based (vouchers, coupons, gifts

or lotteries for vouchers). The analysis of the comparative effectiveness of different types of incentives is crucial not only theoretically (why do some work better than others?) but also on practical grounds (which is the type of incentive most likely to work?).

For blood donation, the question of which type (but not size) of incentive to offer is a particularly debated topic. Scholars and policy makers often propose nonfinancial incentives to avoid the menace of crowding-out (Sass, 2013). A couple of recent observational studies suggest that nonfinancial incentives may be a successful approach. Lacetera and Macis (2010a) reported that donors report they would stop donating blood if given cash but not a voucher of the same nominal value whereas Costa-i-Font et al (2013) found that people who favoured monetary rewards for blood donation are less likely to be donors but those who favour non-monetary rewards are more likely to have donated. These authors suggest that the (still hypothetical) negative effects of incentives in blood donation would be minimised by offering goods-based rewards instead of cash-based incentives. But hitherto it remains unclear if this self-reported data is supported by behavioural evidence. I will provide data on this topic by comparing financial versus nonfinancial incentives in the meta-analysis about blood donation (chapter 3).

Compliance provides a wider setting to analyse different incentives. There are a few randomised controlled trials that tested the impact of different incentives, which have compared cash versus vouchers of an equal value. Cash was consistently more effective than vouchers in promoting health behaviour in all studies (Deren et al, 1994; Kamb et al, 1998; Malotte et al, 1999, 2004; Tulsky et al, 2004; Vandrey et al, 2007). However, Kane and colleagues (2004) performed a review on a broader range of incentives and reported a frequency analysis in which negative incentives (e.g., sanctions) were effective in 90% of the cases, vouchers 80%, cash 73%, free medical charges 67%, lotteries 60% and gifts 57%. These findings seem to contradict the results from the randomised controlled trials about cash vs. vouchers but a more precise data analysis is still required to establish these results more accurately. Also, Promberger and colleagues (2012) showed that grocery vouchers were more acceptable than cash or vouchers for luxury items (about a 20% difference). But this previous field studies raise the questions if stated preferences are consistent with behaviour.

About incentive size, there are only a couple of studies examining this issue and both in the context of compliance. A field study compared the offer of $5 cash versus $10 cash (Malotte et al. 1998) and showed no significant difference between the incentives. But a meta-analysis in the context of drug abstinence (Lussier et al, 2006) showed a positive

effect of incentive size: the larger the incentive, the higher the likelihood to change behaviour. Again, it is not clear if the results of a clinical population in context of drug abstinence hold for the compliance of nonclinical patients. To address this gap, both the impact of incentive size and different types of incentives (cash, vouchers and lotteries) will be examined in meta-regression (chapter 4).

The two field studies also include the test of different type and size of incentives but add the combination of other elements. In the first field experiment (chapter 5) I will test vouchers versus lotteries both framed either as a potential loss or as a potential gain. Message framing has been extensively applied to health settings but mostly this framing has been related to the different presentation of the outcomes of engaging or not in healthy behaviour (Rothman & Updegraff, 2010; Rice, 2013). The framing of offers or benefits to engage in healthy behaviour (not the health outcomes that derive from e.g., treatment or screening) has been significantly less explored (e.g., Romanowich & Lamb, 2013).

In the second field study (chapter 6), I will test the impact of incentives offered either as a single payment (€10) or two instalments of equal amount (€5+€5) which provides indirect evidence for the effect of incentive size. But this study fundamentally contributes to the scarce research about the structure of incentive delivery and the field test of preferences for sequences of outcomes. The few lab-based studies about this topic (Loewenstein & Prelec, 1991, 1993; Linville & Fischer, 1991; Thaler & Johnson, 1990) suggest a preference for segregation of gains but the impact of integrating or segregating an incentive payoff has never been examined in the field. I test the effect of segregating incentives to increase the uptake of colorectal cancer screening, by comparing the impact of a single incentive (offered at the end of screening) versus two incentives with an equal total payoff (one offered at the beginning and the other at the end of the screening process).

1.3.3 Research Question 3

Are income and past behaviour effect modifiers of the impact of incentives?

Patient income and past behaviour are hypothesized to be two important effect modifiers of the impact of financial incentives. A special attention is given to income because the effectiveness of incentives according to deprivation level is a topic that raises contradictory opinions. On one hand, the offer of financial incentives is expected to be more effective in low income patients than more affluent individuals. Given a diminishing marginal utility of income (Layard et al, 2008), the marginal positive effect of a e.g., £10 increase in real

income becomes progressively smaller the higher the initial level of income. Assuming that low income patients are more likely to be influenced by incentives, some authors think (Doran et al, 2008; Oliver & Brown, 2012) that incentives could be used as a policy tool to tackle health inequalities. But others consider that this expectation can be considered as coercion and bribery (Popay, 2008). Incentives might coerce low income people into changing behaviour because under high deprivation, the incentive offered may be necessary to fill basic needs and thus, unlikely to be refused. With respect to blood donation, the question of the low income of donors is not raised as a liability for themselves but to others. One of Titmuss' main concerns was related to an adverse effect of financial incentives in the quality of the blood donated by attracting at-risk deprived donors.

Despite the ethical considerations around the offer of incentives being out of our scope, it is important to understand the role of income as a possible moderator of the effectiveness of incentives. If incentives only work for low income people, incentives should not be used to promote health behaviour changes in more affluent individuals. I will present meta-regression data of the impact of patient financial incentives in individuals with low versus higher income (chapter 4).

It is also unknown if there is an interaction between financial incentives and past health behaviour. Past behaviour tends to be a strong determinant of future behaviour (Chandon et al, 2011; Gardner & Lally, 2012; Lally & Gardner, 2013) through learning and habit formation (Lally et al, 2010; Crawford, 2010). Previous compliance (or lack of compliance) behavior is likely to moderate the effectiveness of incentives in influencing present behavior. Incentives may reinforce past compliance i.e., previously compliant patient may consider the offer of a financial incentive an additional benefit and sustain their compliant behaviour. In opposition, the offer of an incentive could have a detrimental impact in past compliers by introducing an element of control and perceived lack of autonomy (e.g., Falk & Kosfeld, 2006). In the case of patients who were previous noncompliers, incentives should have a positive impact if the utility gained overcomes perceived barriers and costs to compliance.

This question is related to the hypothesis of crowding-out effects and past behaviour can be taken as a proxy for intrinsic motivation. The literature on motivational crowding-out (Deci & Ryan, 2012; Bénabou & Tirole, 2003; Frey & Oberholzer-Gee, 1997) suggests that high levels of pre-incentive behaviour may be interpreted as a sign of high intrinsic motivation. This stream of literature (e.g., Deci & Ryan 1985) has always

defended that incentives are only expected to reduce intrinsic motivation when they are perceived as controlling of autonomous behaviour but might actually enhance effort to engage in new behaviour for which people are not intrinsically motivated at baseline (Promberger & Marteau, 2013). There is limited evidence on this topic but mostly suggesting that financial incentives work by attracting people not previously engaged with health behaviour (Charness & Gneezy, 2009; Stone et al, 1998). This was also a hypothesis posed by Titmuss for blood donation: incentives could alienate previous voluntary donors and attract new blood 'sellers'. In the meta-analysis of blood donation (chapter 3), a subgroup analysis will be performed to separate the impact of incentives for first-time donors and habitual donors.

1.4 Outline of Research

This work is structured in six chapters in addition to this introductory chapter.

Chapter 2 starts by presenting a literature review on financial incentives, starting with the groundwork in Psychology with behaviourism and operant conditioning (i.e., the study of behavioural change originated and maintained by reinforcement or punishment) which deeply influenced economic theory. This early research in operant conditioning is also important to understand the later discussions on motivational crowding-out. I will then discuss the standard economic theory standpoint on financial incentives, followed by the presentation of the framework of behavioural economics. I will particularly discuss how standard economic theory and behavioural economics differ in their hypotheses about the effectiveness of incentives. Finally, the literature on motivational crowding-out will be extensively debated given its centrality in the deliberation about the use of incentives to change health behaviour.

Chapter 3 and 4 present the systematic reviews and meta-analyses of this work.

Chapter 3 reviews the empirical work on incentives and blood donation. It is a systematic review and meta-analysis to test Titmuss' hypotheses about the impact of using incentives in the quantity and quality of the blood donated. It brings empirical data to the much debated problem of offering incentives to increase blood supply, to which no substantial

evidence-based progresses have been made since Titmuss in 1970. Although this the only empirical piece of work dedicated to blood donation in this thesis, I endorse that it makes a critical contribution to research and policy. I fundamentally contribute to the literature with a much need empirical analysis of Titmuss' claims. An earlier version of this chapter is published in the journal *Health Psychology*, in the special issue of *Behavioural Economics in Health*.

Chapter 4 synthesises past experimental research using patient financial incentives to promote health care compliance. I perform the first meta-analysis in the literature to estimate of the effect of incentive interventions. Meta-regression is used to estimate differences by type and size of incentive as well as patient income and past behaviour. A shorter version of this chapter is currently under review in the journal *Social Science and Medicine*.

Chapters 5 and 6 report on two large field studies to test innovative incentive schemes, both in the context of compliance. The field studies are developed in the contexts of Chlamydia screening (Chapter 5) and colorectal cancer screening (Chapter 6). The rationale for the choice of these two contexts is threefold: a) Chlamydia and colorectal cancer have a high prevalence in their target populations (young people aged 18-25 and older people 50-74), b) can be easily detected at premature treatable stages but c) the average uptake of screening is low in most countries, even in countries like the UK with established population-level free screening programmes.

Chapter 5 is a cluster randomised trial (N=1060) testing a factorial design intervention: the offer of financial incentives (£5 voucher vs. lottery ticket for £200) framed as a potential gain or a loss. Financial incentives have been increasingly used by Primary Care Trusts in the UK in an attempt to increase screening rates and mostly under the form of vouchers or lotteries. The only evaluation study in the UK (Zenner et al, 2010) suggests a positive impact, mostly from vouchers. However, this conclusion is based on observational data and no causal link could yet be established. Furthermore, research on gain versus loss framing of health message is well-established but there is hardly any work about the impact of framing incentive offers. This study has been published in a special issue on *Nudge* in the journal *Applied Economic Perspectives and Policy*.

Chapter 6 is a randomised controlled trial (N=2478) testing the impact of incentives to promote the uptake of colorectal cancer screening. Incentivising colorectal cancer screening provides a naturalistic setting to test how people prefer the distribution of gains (incentives) in a temporal sequence of events. Screening is typically a multistep process and I test the effect of a one incentive (offered upon completion of screening) versus two incentives of the same amount (offered at the beginning and the end of screening). This field experiment makes a pioneering contribution to the literature by providing the first experimental test of preference for sequences of outcomes in the context of a critical public health setting. Colorectal cancer is the 3rd most common cancer worldwide after breast and lung cancer (WHO, 2012). There is limited work on interventions to promote colorectal screening and only two studies offering financial incentives (Freedman & Mitchell, 1994; Miller & Wong, 1993) – showing contradictory results. This work received the *Honourable Mention for Best Student Paper* by the Portuguese Health Economics Association in October 2013.

Chapter 7 examines the breadth and strength of the evidence provided to answer the three research questions posed and discusses my original contributions to the literature. It presents the implications of this work for research and policymaking – particularly related to recommendation or not of financial incentives to change health behaviour in specific contexts and population segments. Furthermore, this chapter acknowledges possible limitations and weaknesses of the research and debates the question of generalisability and external validity of the results. Future research prospects are also outlined.

Chapter 2

Literature Review

This chapter presents the literature review about financial incentives. I start with a presentation of the theoretical basis for the use of incentives to change behaviour, initially grounded in operant conditioning in psychology and later translated into standard economic theory with the law of demand, income effect and the principal-agent theory. I will then argue how the predictions from operant conditioning and standard economics do not seem to apply in some circumstances, discussed under the designation of motivational crowding-out effects. I will conclude this chapter with an outline of behavioural economics, its contributions to research on behaviour change and how behavioural principles, mostly derived from Prospect theory, may improve incentive interventions.

2.1 The Law of Effect and operant conditioning

The Law of Effect, enunciated by Thorndike (1911), was the first attempt to systematise the hypotheses about the impact of external rewards and punishments. Based on decades of work with animal behaviour, Thorndike proposed that "o*f several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal will, other things being equal, have their connections with that situation weakened, so that, when it recurs, they will be less likely to occur*" (p. 244). In his studies – similarly to most studies developed after Thorndike in this same line of research – animals were put into experimental boxes and had to provide a certain response (e.g., press a bar, pull a lever, push a button) to obtain food or avoid pain. This experimental apparatus formed the basis of research on operant behaviour (Postman, 1947). Operant behaviour is behaviour controlled by its consequences; operant conditioning is the study of behavioural change originated and maintained by reinforcement or punishment (Standdon & Cerutti, 2003).

Research on operant conditioning, formally initiated by Thorndike, was later developed and expanded particularly by Skinner (1938, 1953, 1969) which took the leap from animal results to human applications. This application of the principles of operant conditioning used (among others stimuli) financial incentives as reinforcers (offering cash or reducing the price of some good) or punishers (increasing fees or decreasing allowances).

Figure 2.1 shows the different forms of operant conditioning which have been defined for human subjects (Martin & Pear, 2007). Operant conditioning is operationalised through reinforcement or punishment. Reinforcement is about giving people what makes them feel good whereas punishment is related to increasing levels of discomfort. The former is expected to enhance the likelihood of desirable behaviour and the latter to decrease the likelihood of undesirable behaviour. Punishment is implemented by increasing pain (positive punishment) or by decreasing pleasure (negative punishment). Reinforcement is slightly more complex. Positive reinforcement is implemented by providing rewards that increase pleasure and or negative reinforcement decreases pain. People reduce their internal levels of discomfort either by eliminating a source of pain (escape) or by avoiding an expected pain (avoidance).

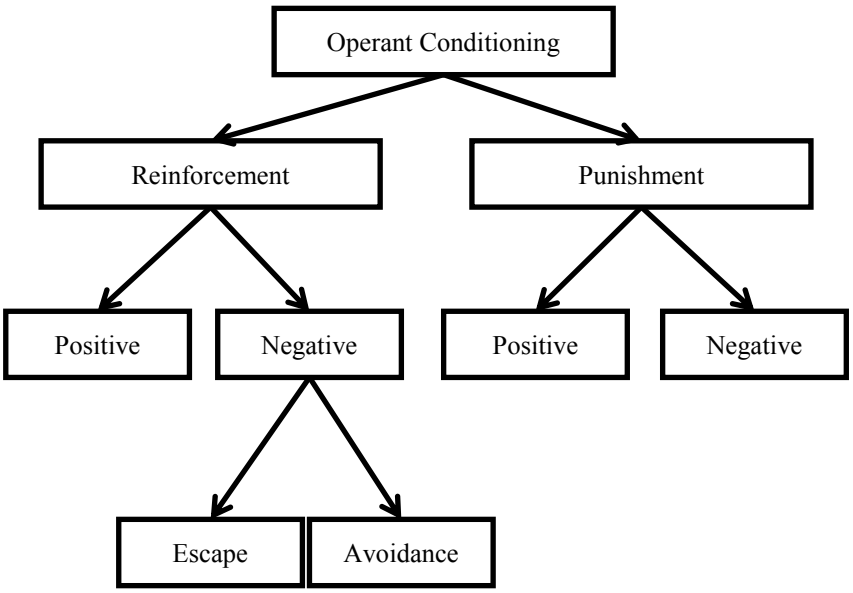

Figure 2.1 Different types of operant conditioning

Operant conditioning principles applied to the analysis of human behaviour are traditionally referred to as behaviour modification (Martin & Pear, 2007). This application started during the 1940s with the objective of increasing adaptive behaviour through reinforcement and decreasing maladaptive behaviour through punishment. Early application of these principles mostly targeted mental health patients and disruptive school behaviour (Petry, 2000). Research in these contexts is also designated as token economy and contingent management. A token economy mimics a small-scale economy with the inmates of health institutions - usually dedicated to mental health (Kadzin, 1982). A token is an object or symbol that can be exchanged for material reinforcers, services or privileges. Tokens aren't primary reinforcers but secondary or learned reinforcers much in the same as money in real economies. Contingency management is a related type of program, most often directed at the treatment of substance use (Higgins et al, 2012). In voucher-based contingency management, patients earn vouchers exchangeable for retail items contingent upon objectively verified abstinence from drug use or compliance with medication. This particular form of contingency management was introduced in the early 1990s as a treatment for cocaine dependence and has been proved highly effective (Lussier et al, 2006).

This psychological literature is an important line of research to understand the use of financial incentives as tool for behaviour change because it pioneered the systematic

study of external stimuli in animal and human behaviour and had, many years later, a decisive role in the research about intrinsic motivation and motivational crowding-out – which will be present in a subsequent section.

The modern application of incentives to behavioural change – either in economics or psychology - is fundamentally different from the initial operant conditioning research. Operant conditioning was developed originally to study learning processes and understand what determines future behaviour. Reinforcement (punishment) would increase (decrease) the likelihood of future desirable (undesirable) behaviour and thus, promote learning. Therefore, past experience with the incentive is the driving force behind the effect in present behaviour.

However, with time, the principles of operant conditioning became tools to change present behaviour, with a radical change from a forward to a backward prediction of behaviour. Anticipated utility (or disutilty) is now the underlying mechanism that explains behaviour change. The promise of a reinforcer or punisher contingent with the performance of some behaviour is expected to increase or decrease the probability of that behaviour occurring. Expectancy and not experience drive behaviour change in the modern use of operant conditioning.

2.2 Financial incentives in standard economic theory

The economic analysis of decision-making largely amounts to understanding the differences in the choice structures faced by individuals. In this way, economic theory works under similar assumptions as operant conditioning. It expects that behaviour is influenced by its expected positive or negative consequences. People respond to changes in benefits or costs as these modify the choice structures in which decisions are taken (Laffont & Mortimer, 2009). Economic theory derives its strength from predicting how people make cost-benefit calculations and change their behaviour in response to changes in incentives (Fehr & Falk, 2002). The effect of incentives in behaviour is formalised in the economic law of demand which states that, all else being equal, the consumption of most products or services will increase as cost decreases.

An incentive is understood as any factor (financial or non-financial) that enables or motivates a particular course of action, or counts as a reason for preferring one choice to the alternatives. The most common distinction is between positive (reinforcement) and negative (punishment) incentives (Crumm, 1995; Smith, 2004), considering that *positive* refers to an addition in utility and *negative* refers to a subtraction in utility. A positive

incentive is an economic, legal or institutional measure designed to encourage beneficial activities to the economy or society. Both positive and negative reinforcement are considered positive incentives. Salaries, grants, awards, cash transfer or any kind of reward is considered positive reinforcement while reimbursement of expenses, free access to services, rebates or removal of sanctions correspond to negative reinforcement. Negative incentives (or disincentives) are mechanisms designed to discourage activities that are considered harmful or detrimental to the economy or society. Similarly, both positive and negative punishments are defined as negative incentives. Taxes, fines and penalties are considered punishers whereas the loss of benefits or cuts in bonuses acts as negative punishers by withdrawing previous rewards.

Under the principal-agent theory (Holmstrom and Milgrom 1991), financial incentives will improve agent performance because the agent will increase effort to earn the incentive (Lazaer, 2000). The underlying mechanism of this theory is that performance is a function of effort, and that introducing desirable monetary incentives will motivate the agent to put forth greater effort (Bonner et al, 2000). Although effort is costly, the agent wants to earn the incentive, thus increasing effort and subsequently performance. This disciplining or price effect is at the heart of agency theory, rational choice, and utility maximization (Frey, 1997).

The core assumptions of standard economic theory state that people have a scarcity of means - e.g., money, time, cognitive capacity - and face choices between competing ends. Individuals have preferences that are stable and well-defined and choose *as if* they were balancing the costs against the benefits of several alternatives. This process has the purpose to maximise expected utility given preferences and constraints. Standard economics assumes that people know what will make them better off and that they achieve such a state – given the resources available to them – by choosing in a calculated and deliberate way among the accessible alternatives. This rational choice framework is not bounded by a specific content and could be virtually applied to any human behaviour (Becker, 1976). The law of demand and the relative price effect work through the use of external incentives and motivation or preferences are taken to be given constants (Frey & Jegen, 2001). The use of financial incentives in experimental economics is also considered crucial to elicit more reliable incentive-compatible responses (Camerer & Hogarth, 1999; Samuels & Whitecotton, 2011).

What are the implications of the theories discussed to this point for the use of patient financial incentives? Both economic theory and operant conditioning predict that

incentives will increase the likelihood of desirable behaviour. Within the economic theory, both health care compliance and blood donation are predicted to occur when the anticipated utility of complying (e.g., peace of mind, warm glow) is higher than the utility of non-adherence (e.g., staying home) or the costs of performing it (e.g., pain). Likewise, non-adherence is predicted when the anticipated utility of not adhering to treatment exceed the disutility of adhering. In a much similar way, the principles of operant conditioning support that behaviour is strengthen or eliminated by its positive or negative consequences. If acting in a certain way e.g., taking my medication, will result in getting a reward e.g., $10, then I am more likely to take my medication because my behaviour was positively reinforced.

However, opponents of the use of incentives to change patient behaviour (e.g., Popay, 2008) call attention to the multifactor nature of the barriers identified in health settings, which may suggest that there may be no universal prescription to tackle this problem. But underlying all noncompliant behaviour is the perception of some cost. Health care compliance represents a small certain increase in immediate costs (e.g., regardless of this cost being waiting time, fees or painful side-effects) to gain uncertain larger future benefits (e.g., increased life expectancy). Given that uncertainty about the length of life is a key determinant of the trade-off between present and future choices (Bommier, 2006; Bommier & Villeneuve, 2012) noncompliance can be considered rational behaviour. An incentive may change these cost-benefit calculations. The utility of future gains and disutility of future costs are heavily discounted and people tend to prefer small immediate rewards to larger delayed rewards and tend to postpone small immediate costs that may become larger future problems (Frederick et al, 2002; Monterosso & Ainslie, 2007). Given that individuals tend to have present-biased preferences (Daugherty & Brase, 2010), the offer of a financial incentive may offset the impact of time discounting by increasing present benefits (Reach, 2008). With respect to blood donation, the matter of uncertainty about future benefits is less pertinent. Low blood donation rates are likely to be primarily explained by a perception of immediate present costs and, according to standard economic theory, incentives should increase supply by transforming a donation into a net gain for donors.

This suggests that all barriers reported by individuals as causes for poor compliance with health behaviour can be framed as costs – physical, cognitive or emotional. These perceived costs, notwithstanding their different natures, can be interpreted similarly and be considered an expression of revealed preferences (Lamiraud & Geoffard, 2007). Let's take

the example of a woman that reports lack of time as the reason to miss cervical screening. Personal time is a scarce resource and this time is used to enjoy different activities that enter the individual utility function, the aim being maximising utility. At equilibrium, the ratio of time allocated to different activities equals the ratio of expected utilities. An increase (decrease) in the relative cost of an activity i.e., waiting time to see the doctor would tend to decrease (increase) the time allocated to that activity. The same rationale can be applied to other reported barriers. Given the consistent evidence that increased costs decrease compliance with health guidelines (Mojtabai & Olfson, 2003; Gibson et al, 2005; Hsu et al, 2006), an increase in perceived benefits with the contingent application of financial incentives is predicted to increase health behaviour.

The bottom line is that standard economics (and operant conditioning) provide an overarching normative framework that makes general predictions about how behaviour will change in response to changes in incentive structures (Fehr & Falk, 2002) – and because it can be applied to a wide set of behaviours and explains many behavioural regularities, it has become the fundamental theoretical foundation for policy making.

2.3 Motivational crowding-out: Exceptions to the general rule?

However, the general predictions of standard economics and operant conditioning may not always apply. Titmuss's manifesto for altruistic blood donation in his seminal book *The Gift Relationship* (1970) marked the start of wide-scale discussions about possible unanticipated or detrimental effects of offering financial incentives to individuals. This initially vague discussion later became labelled by Bruno Frey as the much cited concept of motivational *crowding-out (*(Frey, 1994, 1997; Bénabou & Tirole, 2006; Frey & Oberholzer-Gee, 1997). Motivational crowding-out is the overarching term used in economics for an adverse and unexpected effect of incentives. Crowding-out effects are considered to be present when incentives promote changes in behaviour contrary to the expected direction, that is, rewards decrease the likelihood or frequency of behaviour and penalties increase it (Bénabou & Tirole, 2006; Frey & Oberholzer-Gee, 1997; Kreps, 1997).

Although Titmuss is often referenced as the first author to debate the relationship between motivation and external rewards and Bruno Frey pioneered the label of motivational crowding-out (1994), this research question was born in Psychology many years before either of these authors. Research on operant conditioning in animal behaviour – discussed in the previous section - identified the first signals that animals could have an

internal motivation system independent of external rewards (White, 1959). The behaviour of animals could be greatly predicted by the reinforcement or punishment stimuli used by the experimenter but there were many instances (puzzling to researchers) where the animals refused food to play in the experimental maze or wheel – even when induced hunger (Postman, 1947). The underlying reasons were unknown to researchers but the animal displayed an intrinsic need to master the environment and satisfaction was derived from it (White, 1959). This spurred criticism that the existent theories of motivation were strictly built upon primary drives and could not account for playful and exploratory behaviour, particularly in humans. Thus, new motivational concepts as 'competence' or 'intrinsic motivation' were proposed.

Much of the early research inspired by this evidence was conducted in children using the same experimental paradigm as the studies in operant conditioning in animals. Animals were observed in what was designated free-operant behaviour i.e., what happens to behaviour after removing the restrictions of the behavioural intervention. So did children in the early studies about intrinsic motivation (Promberger & Marteau, 2013). Intrinsic motivation was defined as performance of a task with "no apparent rewards except the activity itself" (Deci, 1971, p. 105) and operationalised by choosing tasks that participants already performed with sufficiently high persistence (puzzle solving and writing student newspaper headlines or spontaneous interest in a new drawing opportunity) (Promberger & Marteau, 2013). Deci (1971) and Lepper, Greene, and Nisbett (1973) tested the hypothesis that rewards might undermine intrinsic motivation, by comparing behaviour levels between a group that received a tangible reward and a group that received no such reward, after the reward had been removed. Both studies found that behaviour levels were lower in the group that had previously been rewarded.

Two decades after this experimental paradigm developed in the literature, a couple of large meta-analyses examined the prevalence of the undermining effect of rewards (Cameron & Pierce, 1994; Deci et al., 1999). These meta-analyses come to different conclusions, either that the undermining effect of tangible external rewards on intrinsic motivation is pervasive (Deci et al., 1999; Deci, Koestner, & Ryan, 2001), or that it is limited (Cameron, 2001; Cameron, Banko, & Pierce, 2001; Cameron & Pierce, 1994) (Promberger & Marteau, 2013). Despite these differences in the evaluation of the impact of incentives, intrinsic motivation this literature "has always been defined in terms of reward effects on intrinsic motivation for interesting activities" (Deci et al, 2001). Following the original definition and operationalisation of intrinsic motivation, high levels of pre-reward

behaviour are assumed to imply high intrinsic motivation. Deci and Ryan (1985) predicted that rewards only reduce intrinsic motivation when they are perceived as controlling the behaviour, and might actually enhance intrinsic motivation if they promote feelings of competence (Promberger & Marteau, 2013).

This entails that all goal-oriented activities i.e., activities that are performed as means to obtain something are not be in the realm of intrinsic motivation. This also implies that all health care behaviour should not be considered intrinsically motivating: disease screening or vaccines are not particularly enjoyable. Blood donation is also not enjoyable in itself – people do it to help others. Furthermore, according to the psychological literature, motivational crowding-out should occur under high levels of pre-incentive motivation, what is unlikely to happen for patients that, at baseline, do not comply with health care or do not donate blood. The main question from this stream of research is whether incentives will be interpreted by patients as controlling or as an opportunity to increase 'competence' in taking care of their own health. From the available evidence, it is not clear yet which circumstances will trigger a positive or adverse effect of incentives.

The definition of intrinsic motivation was progressively expanded in Economics (Kreps, 1997; Frey, 1997; Frey & Oberholzer-Gee, 1997; Benabou & Tirole, 2003) to include not only things that people enjoy doing but also what people think they should do and its definition extended to any effect that is opposite to the relative price effect of economic theory. Frey and Jegen's (2001) motivation crowding theory builds on the psychological literature and also include the perception of the incentive as controlling or undermining autonomy as the mechanism that leads to motivation crowding-out.

Nonetheless, contrasting with studies in psychology, crowding-out effects within economic research are identified when unforeseen changes occur in behaviour concurrent with the incentive offer, rather than after its removal. Curiously, however, the only piece of evidence Titmuss initially presented in his work that suggested a negative impact of incentives is related to post-incentive donation behaviour, more in line with the psychological tradition. Referring to survey data from the former Soviet Union, Titmuss stated that only 72% of donors reported they would keep donating if payments were withdrawn and only 50% of donors would donate as often as they currently did.

Economic studies on motivation crowding-out include new and often more complex contexts than the puzzles and tasks used in the psychological literature, including prosocial and citizenship behaviour (Frey, 1997; Promberger & Marteau, 2013). Laboratory studies often use economic games that require some cooperation between parties or a trade-off

between interests of different parties, as in principal-agent problems involving an agent acting with consequences for the principal, who relies on the agent, such as an employer relying on employee work effort (Promberger & Marteau, 2013). Questionnaire measures of real-world voting decisions have also been used. Frey and Oberholzer-Ghee (1997) found acceptance of the siting of a nuclear waste repository close by dropped from about 50% to about 25% when financial compensation was offered. Volunteers who were paid a small amount worked fewer hours than unpaid volunteers (Frey & Goette, 1999).

Generally speaking, in the economic literature the concept of motivational crowding-out is explained in reference to social preferences. Agents have preferences other than money and these preferences may interfere in the relationship between monetary incentives and effort. Many of the unintended effects of incentives occur because people act not only to acquire economic goods and services but also to constitute themselves as dignified, autonomous, and moral individuals (Bowles & Hwang, 2008) and the offer of an incentive may inform the agent that the principal does not trust him or wants to control him (Bénabou & Tirole, 2003). This is a possible explanation why the public acceptability of financial incentives may be low in situations in which the values of human dignity, autonomy or solidarity are salient (Park et al, 2011; Promberger et al, 2011, 2012). Monetary incentives have been proven detrimental to 'other-regarding' preferences by triggering self-interest (Bowles, 2008): the mere priming of money has been shown to increase selfish behaviour (Vohs et al, 2008).

Bowles and colleagues (Bowles and Kwang, 2008; Bowles and Polania-Reyes, 2012) claim that standard economic theory predicts independence between incentives and social preferences based on a separability assumption (Bowles and Polania-Reyes, 2012): changes in social preferences are not dependent on the presence and magnitude of financial incentives. But there is increasing evidence showing that this separability assumption does not hold. More often than not, research has suggested that monetary incentives crowd-out nonmonetary motivations – acting as substitutes.

Bowles (2008) based this claim on a series of field studies suggesting an adverse effects of monetary incentives in situations involving pro-social or citizenship behaviour. In Haifa (Gneezy and Rustishini, 2000), at six day care centres, a fine was imposed on parents who were late picking up their children at the end of the day. Parents responded to the fine by doubling the fraction of time they arrived late. When after 12 weeks the fine was revoked, parents increased lateness persisted. In a natural experiment, Holmås and colleagues (2010) found that hospital length of stay was longer in a hospital using fines to

reduce length of stay compared with a hospital not using monetary punishment. Similar adverse effects of monetary incentives in social preferences have also been reported in rudimentary small-scale societies (Heinrich et al, 2005).

Bowles and colleagues (2008) interpret the results as examples of monetary incentives crowding-out agents' intrinsic motivation, leading to a reduction in effort. While acknowledging that other interpretations are possible, the authors support these counterproductive effects illustrate a kind of negative synergy between monetary incentives and moral behaviour. Taken together, this evidence suggests that financial incentives should be effective when offered to individuals to take care of their own health – as in the case of compliance with health care - but not when their actions influence the health or well-being of others – as the case of blood donation.

Although increasing numbers of studies uncover exceptions to the income effect, the conditions under which they occur are currently not well understood (Gneezy et al, 2011). The vagueness of the definition of intrinsic motivation in the economic research creates uncertainty about what to expect in the health contexts analysed in this work. Promberger and Marteau (2013) performed a comprehensive systematic review of the literature and also concluded that the available evidence does not allow drawing clear implications for health behaviour.

My work will add to the literature on motivational crowding-out by providing evidence of the impact of financial incentives to change the health behaviour in the field Again, it should be reinforced that possible detrimental effects in intrinsic motivation will be inferred from observable changes in behaviour. I will contribute to long-standing debate about the impact of incentives in blood donation and I will also offer evidence for compliance with health care, which integrates a large and important set of health behaviours.

2.4 Financial incentives in behavioural economics

Behavioural economics integrates psychological insights – mostly from cognitive psychology - into mainstream economics in an attempt to address some of the descriptive limitations of standard theory (Dellavigna, 2009; Heap, 2013; Loewenstein et al, 2013). The analysis of how social preferences affect the relationship between incentives and behaviour – discussed above as a possible cause for crowding-out effects - is one of the core features of behavioural economics. However, most of the earlier and distinctive contributions of behavioural economics to the literature are related to the bounded

rationality of agents. Assuming the bounded rationality of agents brings about a different set of implications for incentive interventions that I will discuss next.

The initial developments of behavioural economics were born from the query about the validity of the maximisation assumption in standard economic theory. Herbert Simon introduced the concept of bounded rationality as the descriptive alternative to maximisation (Rice, 2013). He claimed that people face several cognitive limitations in how much information they can process and how much they can remember when needed. Moreover, because people have to make decisions about a large number of things, they intuitively use shortcuts or heuristics rather than engaging in utility-maximising behaviour. Therefore, people satisfice rather than maximise as a way of mitigating what would otherwise be an overwhelming amount of information given their limitations in cognition and time. Simon argued that far more attention should be given to decisions making processes per se and this formed the foundation for behavioural economics because standard economic theory assumes that people will choose the best option available by simply matching their preferences with price and quality data. He incited research to understand this 'heuristic thinking' better and the initial decades of Kahneman and Tversky's work were dedicated to the update of the rational agent model (Kanheman, 2003).

Over time, research proved Simon's hypotheses right and research on bounded rationality expanded showing that lay reasoning does not always adhere to the laws of logic, the calculus of probability or the maximization of expected utility (Gigerenzer & Gaissmaier, 2011; Kahneman, 2003ab). Individuals have been shown to misunderstand complex information about costs and benefits (Liebman & Zeckauser, 2004) and misinterpret data about risk and uncertainty (Gigerenzer & Galesic, 2012). People tend to put off difficult choices and in some extreme situations may avoid choosing altogether (Tversky & Shafir, 1992; Luce, 1998). Most individuals are highly influenced by the context in which choices are presented (Gallagher & Updegraff, 2012) and make inaccurate predictions about the consequences of their past decisions (Wilson & Gilbert, 2005).

What are the implications of bounded rationality literature to incentive interventions? Primarily, it draws attention to the possibility that financial incentives – as tools aiming to foster cost-benefit calculations and rational choice – may not always work as expected by standard economics (Ariely et al, 2009). It also highlights the importance of understanding how patients code, organise and structure the information regarding the

offer of the financial incentive. This is the stance taken by Thaler and Sustein (2008), according to which financial incentives are powerful policy tools that behavioural economics does not overlook. In fact, market price incentives should be adjusted in terms of salience and framing i.e., incentives should be highlighted in comparison to the current status quo (reference point) and should be framed in the most motivating way to people, according to behavioural principles. I will now present and discuss the principles and concepts from prospect theory as a key framework to motivate and inform the design of incentive schemes.

2.5 The contribution of prospect theory

Criticisms to behavioural economics are very much in line with criticisms to psychology made by economists. Although behavioural models have proven to be, on average, descriptively more accurate, there is no overarching model of human behaviour from which general predictions can be made. Behavioural economics and psychology are based on a myriad of lower level models that are contextually bounded, lacking tractability and parsimony.

One of the chief exceptions to this criticism is prospect theory, which provides a higher degree of formalisation compared to most psychological models. Prospect theory (Kahneman & Tversky, 1979) has been the most influential framework offered under the outskirts of behavioural economics. This is a descriptive theory of decision-making under risk which main features were also applied to riskless choice a decade after its initial formulation (Tversky & Kahneman, 1992). This theory has been shown to have a high descriptive validity in several contexts including health (Winter & Parker, 2007; Abellan-Perpinan et al, 2008; Schwartz et al, 2008) and it explain systematic deviations from the rational choice model. Prospect theory models choice as a two-phase process. The first phase involves editing while the second involves evaluation.

2.5.1 Editing Phase

The recognition of an editing phase is a distinctive characteristic from other choice theories. This phase consists of a preliminary analysis of the prospects in question, aiming to provide a simpler representation of the choice elements, facilitating subsequent evaluation. At this stage, individuals organise, reformulate and restructure the options available. People can code options as gains or losses, can combined different prospects with different probabilities or apply segregation rules between risky and riskless prospects.

In prospect theory, outcomes are evaluated via a utility function with a shape as shown in Figure 2.2 and this evaluation is determined by the editing and coding done at this first stage.

Mental accounting is related to the subjective mental arithmetic operations performed by people to evaluate financial prospects (Thaler, 2004). With respect to their own finances, individuals set mental budgets for different expenses i.e., different 'mental boxes' which they allocate to expenses in e.g., food, housing, leisure (Thaler, 1999). There is evidence that these categories or 'mental boxes' are not fungible because people tend to make relatively strict budget allocations (Hastings and Shapiro, 2013). This means that when the budget allocated to a specific account is over, for instance 'Indulgence' (e.g., special dinners, expensive clothing), people typically do not transfer funds from other accounts (e.g., food, transportation) to finance further indulgencies. This is an important point for the design of incentive schemes because the offer of a voucher for a luxury product or entertainment may unexpectedly top-up the indulgence account. Given the typical budget constraints experienced by most people, gift cards for indulgence or luxury goods may be more appealing than grocery vouchers of the same amount.

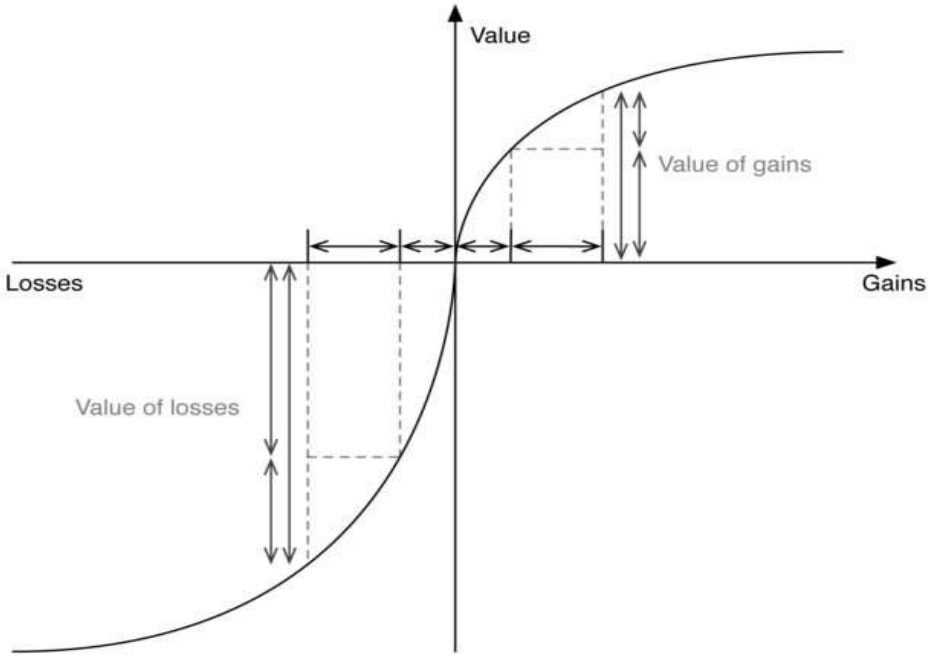

Figure 2.2 Value function from Prospect theory

2.5.2 Evaluation Phase

After the editing phase, individuals engage in the evaluation of the edited prospects. The overall value of a prospect is expressed in terms of two scales, v and π. The first scale, v, assigns to each outcome x a number $v(x)$, which reflects the subjective value of that outcome (Figure 2.2). The second scale, π, associates with each probability p a decision weight $\pi(p)$, which reflects the impact of p on the overall value of the prospect (Figure 2.3). The first scale entails an explanation for (a) reference points, (b) loss aversion and (c) diminishing marginal sensitivity. The second scale is related to (d) decision weighting or weighted probability functions.

a) Reference Point. Outcomes are defined relative to a reference point or status quo (x=0), which serves as a zero point in the value scale. The value function measures the value of deviations from that reference point in terms of gains or losses. It is often assumed that the relevant reference point is current status of wealth or welfare but it can also be expected status or goals. Heath and colleagues (1999) showed that unachieved goals are felt as losses even if there is an absolute gain. Expectations have an important role to play in reference points. When people expect a pay rise of 10% and are just awarded 5%, they tend to be disappointed. In this case, the reference point in not current pay but expected pay and, thus, people are likely code and evaluate the final pay award as a loss (Wilkinson, 2008). This evidence suggests that incentives interventions should emphasise that the reference point is no incentive (zero): patients are not typically offered incentives to care of their health and (in most countries) to donate blood. Thus, the offer of a financial incentive in health settings is a clear departure from patients' reference point and can be highlighted in the framing of the incentive.

b) Loss aversion. The same outcome is valued differently if it is above (gain) or below (loss) the reference point and people are significantly more sensitive to losses than gains [$v(x) <- v(-x)$ for $x>0$]. This is a broad-spectrum effect found in different contexts (Baumeister et al, 2001). Bad experiences, failures and dispossessions are more memorable than their positive counterparts. Although this appears to be a robust effect, its causes are not clear. Evolutionary explanations are among the most endorsed, with evidence tracking loss aversion to our survival instinct (Kim et al, 2006). In health settings, this effect has been particularly explored in the framing of health outcomes (Banks et al, 1995; Rothman et al, 1999; McCormick & McElroy, 2009).

Loss aversion is probably to single most prominent element in prospect theory and it has greatly influenced research and the interpretation of the psychological costs of losses. But interestingly, research from operant conditioning based on animal behaviour strongly favoured positive reinforcement as the most effective strategy to promote and maintain future behaviour (Postman, 1947). The initial work of Thorndike with animals demonstrated that punishment was ineffective to eliminate undesirable behaviour. He showed that the impact of punishment was highly dependent of the organism's propensity to endure pain. It seemed that punishment had an indirect effect in eliminating the wrong response: it mostly increased the variability of behaviour, thus increasing the opportunities for the occurrence of the correct response, which would then be reinforced in the right direction by reinforcement (Postman, 1947). These results seem in striking contradiction with lay conceptions of what drives behaviour change because the effectiveness of punishment has practically become an axiom in the literature.

Despite the great centrality given to loss aversion in behavioural research, Kermer and colleagues (2006) suggest it is mostly an affective forecasting error. Loss aversion occurs because people expect losses to have greater hedonic impact than gains of equal magnitude. In two studies, these authors showed that people predicted that losses in a gambling task would have greater hedonic impact than would gains of equal magnitude, but when people actually gambled, losses did not have the negative emotional impact they initially predicted. People overestimated the hedonic impact of losses because they underestimated their tendency to rationalize losses and overestimated their tendency to dwell on losses. The asymmetrical impact of losses and gains could thus be more a property of affective forecasts than a property of affective experience.

Nevertheless, is often found in the literature the assumption that interventions based on penalties and fees are more effective at changing behaviour than rewards (Li & Chapman, 2013; King et al, 2013; Rice, 2013). However, this hypothesis was never been tested despite the centrality of loss aversion in debates about policy interventions. I will provide evidence from the field about the relative effectiveness of gain versus loss framed incentive offers (chapter 5). This is not a test of penalties versus rewards *per se* but a proxy about how people respond to incentives presented as potential gains or losses (forgone gains).

c) Diminishing marginal sensitivity. Prospect theory considers that the marginal value of both gains and losses generally decreases with their magnitude. Initial improvements from

the reference point are perceived as very significant, with subsequent gains felt less intensively. Similarly, initial losses are the most painful but additional decrements are less so. Kahneman and Tversky (1979) endorsed that the evaluation of monetary changes follows the same pattern as many sensorial and perceptual dimensions: the psychological response is a concave function of the magnitude of the physical change. This point has particular implications to the size of the incentive offer. Diminishing marginal sensitivity in combination with the reference point (which is typically being offered no contingent incentive for health behaviour) suggest that even small financial incentives could trigger significant behavioural changes. I will dedicate a particular attention to incentive size later in this chapter. Incentive size is a central feature of the incentive scheme and will base my discussion not only on Prospect Theory but also on posterior research (Gneezy et al, 2000; Ariely et al, 2009; Pokorny, 2008).

d) Decision weighting. People underweight probable outcomes compared with outcomes that are obtained with certainty (Kahneman & Tversky, 1979). This phenomenon was designated certainty effect because the reduction of the probability of winning from certainty to some probability $p<1$ has a greater effect than the corresponding probability reduction from p_1 to p_2 both $0<p<1$ (Kanheman & Tversky, 1986). Prospect theory porposes that people replace probabilities by decision weights: the value of each outcome is multiplied by a decision weight (Figure 2.3). Nevertheless, decision weights are a function of probabilities: $\Pi(p)=f(p)$. These weights measure the impact of events on the desirability of the prospects and not their likelihood and is possible that $\Pi(p)<p$ or $\Pi(p)>p$.

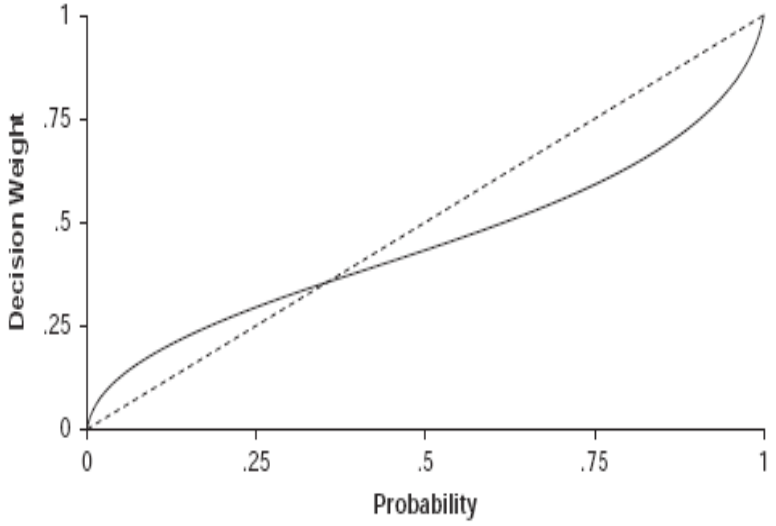

Figure 2.3 Probability weighting function from Prospect theory

Decisions weights are usually lower than the corresponding probabilities except for low probabilities; people tend to overweight small probabilities and overestimate the frequency of rare events. These authors propose that this is the root of the attractiveness of gambling. In later work (Tversky & Kahneman, 1992) they showed that people tend to be risk-seeking for gains of low probability, suggesting that lotteries may be effective incentives to promote changes in health behaviour.

The implications of decision weighting for the design of incentive schemes are not straightforward. On one hand, there is evidence for a robust certainty effect (Kanheman & Tversky, 1979), implying that certain incentives, even if with a smaller expected value than prize draws (Kanheman & Tversky, 1986), should be more effective to promote behaviour change. Additionally, research has shown that people have a strong preference for immediate gratification and amplify the value of immediate (relative to delayed) outcomes. This immediacy effect (Prelec & Loewenstein, 1991) has been proposed as a derivative of the certainty effect (Keren & Roelofsma, 1995). Both uncertainty and time affect behaviour via a common underlying dimension in such a way that making an outcome uncertain is equivalent to making it delayed (Weber & Chapman, 2005a). Thus, offering a prize draw in exchange for a health behaviour that poses immediate costs to patients should be less effective than a certain incentive.

But concomitantly there is evidence that people are risk-seeking (or less risk averse) for gains when payoffs are low (Weber & Chapman, 2005b). People prefer taking risks when only 'peanuts' are involved (Prelec & Loewenstein, 1991) e.g., between a certain £1 and a 10% chance of £10, most people prefer the gamble. Volpp and colleagues (2009) have shown that lotteries with a small expected value are effective to promote adherence to medication – although they did not compare the effectiveness of these lotteries with a certain incentive.

To date, most research examining decision weighting is strictly lab-based, evaluating stated preferences with no effort required from subjects. My hypothesis for field data is that, in the case of health behaviour involving immediate costs for patients, the certainty effect is likely to be dominant, providing a sure compensation. The feeling of uncertainty about the future – which is particularly salient when performing e.g., cancer screening – may lead people to prefer immediate soothing rewards (Milkman, 2012). In this work, I will provide meta-regression (chapter 4) and primary field data (chapter 5) on this hypothesis.

2.5.3 Evaluating Joint Outcomes

The value function from Prospect theory (Figure 2.2) is defined over single unidimensional outcomes that the authors later extended to single, multi-attribute outcomes (Tversky & Kahneman, 1992). Thaler (1985, 2008) extended this analysis to compound outcomes, to answer the question of how a joint outcome (*x,y*) is evaluated. The value function is concave for gains ($v''<0$, $x>0$) and thus $v(x)+v(y)> v(x+y)$. This assumption suggests that gains should be segregated to increase overall utility. Segregated gains are hypothesised to provide more utility due to diminishing marginal utility. The marginal utility of income is defined as the incremental change in utility (or satisfaction) that is due to a unit change in income. The broader concept of marginal utility is the change in utility resulting from a given change in the consumption of a good (Layard et al, 2008). Because the first X% of a gain accounts for more than X% of its hedonic benefit, one can offset diminishing marginal utility by segregating a gain into a smaller a series of smaller gains (Morewedge et al, 2007). At a single point in time, a second unit of the same good provides less hedonic impact than the first. Two gains at different moments may be more satisfactory because, after the first gain, the reference level is reset to zero and the second gain provides a new higher utility. In the case of losses, given that the value function is convex in this domain ($v''>0$, $x<0$), an integration of outcomes is expected to be preferred: $v(-x)+v(-y)< v(-(x+y))$. After a first loss, the reference point is reset to incorporate the new (lower) status quo and a second loss would feel more painful, given the steepness of the value functions of losses.

Joint outcomes may not be strictly positive or negative. A mixed gain is expressed in the form of (x,-y) with $x>y$ implying a net gain whereas a mixed loss is defined by $x<y$, involving a net loss. Thaler (1985; 2008) proposes that losses should be cancelled against larger gains, meaning that a decrease in a gain should be integrated: $v(x)+v(-y)<v(x-y)$. But a small reduction in the absolute value of a loss should be segregated – or what Thaler designates the 'silver lining' effect. For instance, in the case (£40, -£6,000), segregation is preferred since *v* is relatively flat near -6,000. However, if the values are closer as (£40,-£50) integration may be preferred since the gain of the £40 is likely to be valued less than the reduction of the loss from £50 to £10.

Considering the first editing phase of Prospect theory, the prospect of cancer screening, upon the offer of an incentive, can be recoded from a loss to a mixed outcome. A mixed gain is expressed in the form of (x,-y) with $x>y$ implying a net gain. This will be

the case if the incentive overcomes the cost of screening. A mixed loss is defined by x<y, involving a net loss and screening will still ultimately be perceived as a cost if the incentive is not sufficiently appealing to patients.

The scarce evidence on this mental arithmetic for sets of gains and losses comes entirely from lab studies and stated preferences. In the few existent studies, participants are presented pairs of scenarios comparing a single outcome with two outcomes of the same absolute value. In response to the following setting (Thaler, 1985): "*Mr. A was given tickets to lotteries involving the World Series. He won $50 in one lottery and $25 in the other. Mr. B was given a ticket to a single, larger World Series lottery. He won $75. Who was happier?*" As expected, the majority of participants (64%) answered Mr. A. Thaler and Johnson (1990) analysed the evaluation of separate gains that included a temporal order. They proposed that the process of segregating gains is facilitated by having events occur on different days and, conversely, that integrating events should be easier if the events occur on the same day. These authors presented participants (N=65) with the following scenario. There is a pair of events: (i) win a $25 lottery and (ii) win a $50 lottery and these events happen on the same day for Mr. A or two weeks apart for Mr. B. Who is happier? 63% of participants answer Mr. B. Participants seemed to prefer to spread out the arrival of pleasant events, presumably to help segregate the utility experienced and spread good outcomes over time.

There are more studies analysing the impact of integrating losses due to its important marketing applications for consumer purchases e.g., $120 for product plus $20 for shipping or $140 shipping included, mostly corroborating the preference for integration of losses (Kim, 2006; Ross & Simonson, 1991; Thaler & Johnson, 1990; Heath et al, 1995). For mixed outcomes, similar scenarios were employed. From Thaler (1985): "*Mr. A's car was damaged in a parking lot. He had to spend $200 to repair the damage. The same the car was damaged he won $25 in the office football pool. Mr. B's car was damaged in the parking lot. He had to spend $175 to repair the damage. Who was more upset?"* 70% (n=87) answered Mr. B. For mixed gains: "*Mr. A bought his first New York State Lottery and won $100. Also, in a freak accident, he damaged the rug in his apartment and had to pay the landlord $80. Mr. B bought hist first New York State lottery and won $20. Who was happier?*" 72% answered Mr. B.

This rationale of gain segregation, nevertheless, raises an important question of time preferences as an opposing force to diminishing marginal utility. The motivation to spread consumption over time and the motivation to concentrate consumption in the

present are conflicting. People tend to exhibit positive time preferences: individuals are impatient and crave immediate consumption, preferring gains sooner rather than later. And this effect holds either assuming either exponential or hyperbolic time discounting (Frederickson et al, 2002). Also, people have negative time preferences for costs, suggesting that segregation (and not integration) should be preferred. People are expected to want to feel their pains as late as possible. These are considered robust effects in intertemporal choice research (Read et al, 2002). However, studies examining time discounting are concerned on how people evaluate simple prospects consisting of a simple outcome obtained at a specific point in time (Loewenstein & Prelec, 1993).

No research to date has applied research about the coding and evaluation of joint outcomes to behavioural interventions – so far there are only observational and lab studies. The implications for health care settings may be extensive. If no incentives are offered to promote health care compliance, the health procedures should be integrated as much as possible. For instance, present HPV immunisation as a single goal, not three immunisation doses. Given that compliance is likely to be perceived as an immediate cost to patients, the multiple doses should be integrated. But if some incentive is offered to patients, this gain should be segregated and highlighted to patients.

I will present the first behavioural evidence of preferences for segregation versus integration of gains, in a field study using colorectal cancer screening as research context (chapter 6).

2.6 The impact of incentive size

A critical feature of incentive interventions is the value of the incentive offered to participants. Standard economics and operant conditioning make similar predictions with respect to the impact of incentive size. Under standard economic theory, the impact of financial incentives in behaviour is a monotonic function of incentive size (Laffont & Mortimer, 2009). Other things being equal, increased size of incentive will lead to increased likelihood of behaviour change. Larger payoffs both increase the marginal gain for patients and are more likely to cover the costs of complying with health recommendations. The similarities with operant conditioning are particularly visible in this point (Miltenberger, 2011): '*the effectiveness of a stimulus as a reinforcer is greater if the amount or magnitude of a stimulus is greater (...) a larger positive reinforce strengthens the behaviour that produces it to a greater extent than a smaller amount or magnitude of the same reinforcer*' (p.76). The size of the reinforcer is determinant in cost-benefit

calculations and poor effects from incentives are usually attributed to the small size of the incentives offered.

However, there is evidence that the relationship between incentive size and behaviour may be more complex than this general prediction. Heyman and Ariely (2004) proposed two types of markets that determine the association between behaviour and incentives: a social market characterized by social relationships and a monetary market, defined market pricing relationships. They propose that in money-markets, effort will increase with payment level but in social-markets effort will be unrelated to incentive size. This hypothesis was operationalised by the type of incentive offered: participants were offered candies (which was assumed to create a social market relationship) or cash (which was assumed to create a money market relationship). Effort in several tasks was positively associated with the amount of cash received but not by the quality (as a proxy for cost) of the candies offered.

Despite proposing this dichotomy of social vs. money markets that moderate the impact of incentives, Heyman and Ariely (2004) show the expected monotonic relationship between money and behaviour: more cash led to more effort. But there is a growing literature in behavioural economics exposing a nonmonotonic relationship between performance and incentive size. And this has also been interpreted as a sign of crowding-out effects (Conrad & Perry, 2009).

Gneezy and Rustichini (2000) offered students different amounts of money for each correct answer (in a total of 50 questions) in a quiz. Compared to a control group (no payment), very small incentives (2.5 cents per question) led to a worse performance but higher incentives (25 cents or 75 cents per question) led to better performance. The authors mostly highlighted the adverse role of very small incentives and concluded that small (but not large) incentives could have crowding-out effects for effort and performance. However, the authors disregarded the lack of difference between the higher incentives which could lead, respectively for 25 cents and 75 cents per question, to an overall payoff of $12,5 and $37,5.

Some years later, a couple of papers exposed a different pattern between incentive size and behaviour. Ariely and colleagues (2009) also tested the impact of different incentive sizes. Participants were offered 4, 40 or 400 rupees (corresponding to $0.1, $1 or $10) to perform a variety of lab tasks. Overall, they showed that the high incentive led to worse performance than the low and mid incentives – which did not have significantly different effects. Similarly, Pokorny (2008) showed an inverse-U shaped relationship

between incentive size and performance. Compared to a control group (no incentive), participants were offered $0.01 (very low), $.05 (low) or $0.5 (high) incentives per point in a quiz (in a total maximum of 48 points). Results showed that very low and low incentives outperformed the high incentive. Compared to the control group, only the very low incentive led to better performance.

The reasons underlying these nonmonotonic associations are not yet clear. Differences may depend on the context under analysis e.g., work performance versus prosocial behaviour or may be based on concerns with self-image e.g., my performance is not driven by money (Ariely et al, 2010; Gneezy and Rustichini, 2000) that is more salient in social markets than money markets (Heyman & Ariely, 2004). To this point, the implications for health behaviour are difficult to draw. If the role of incentive size is driven by the type of market perceived by patients (Heyman & Ariely, 2004), blood donation may be considered a social market and thus be insensitive to incentive value. Compliance with health care may be a social market or money market depending on e.g., the relationship with the GP. I will explore the impact of incentive size on health behaviour both with meta-regression analyses (Chapter 3 and 4) and experimental field evidence (Chapter 6).

2.7 An integrative framework for behavioural public policy

The discussion of the behavioural research performed to this point will direct the empirical analysis of this work – guiding the hypotheses for secondary data analysis (chapters 3 and 4) and informing the design of incentive schemes for primary data collection (chapters 5 and 6).

This evidence-based approach is different from most research performed to date. Michie and colleagues (2011) reviewed over 1000 interventions and showed that only 15%-20% of the studies were well-defined and grounded in the literature. Most interventions are often poorly defined, not justified by theory and implemented without supporting empirical evidence (Abraham & Michie, 2008).

I propose a classification of the most frequent type of policy interventions using economic incentives according to the main principles of operant conditioning (Table 2.1). Policy interventions always carry underlying behavioural assumptions - even if not explicit – and I suggest this framework for analysis. An attempt to match financial incentives to the principles of operant conditioning provides policy making with a theoretical framework, grounded in behavioural research, and informs the development of policy guidelines based on the effectiveness of each type of incentive.

	Reinforcement	Punishment
Positive	Salaries; Bonuses	Tax increase
	Vouchers, lotteries	Fines
	Cash transfers	Penalties
Negative	Sanction removal	Withdrawal of welfare benefits
	Tax reduction/ exemption	Embargos
	Refund/ Rebate	Cuts in public services

Table 2.1 Categorisation of financial incentives according to operant conditioning

There is some controversy regarding an actual difference between positive and negative reinforcement (Martin & Pear, 2007). Some authors claim that this distinction is not clear because it is not possible to know if individuals perceive a deduction in taxes as positive (increased gains) or negative reinforcement (decreased costs).

Furthermore, in financial terms, there is no positive punishment strictly speaking. The case of physical punishment is more direct: a slap in the face is a true positive punishment because it increases the sensory level of pain. A tax is a punishment because it reduces the amount of available income to individuals and, therefore, could also be considered negative reinforcement. In fact, in most situations behaviour appears to be motivated by avoidance conditioning (Figure 2.1 p.27) which is a type of negative reinforcement e.g., we pay taxes to avoid legal penalties, we behave in public to avoid social censure, we drive within speed limits to avoid a ticket. Loss aversion, in operant conditioning terms, is mostly avoidance of pain (negative reinforcement) because it is referred to the prospect or anticipation of a loss. Operant conditioning research favoured the use of reinforcement to change behaviour (Magoon et al, 2008) whereas behavioural economics, mostly based on the concept of loss aversion, predicts that punishment will be more effective.

If these operant conditioning principles are translated to incentive interventions in the contexts under analysis in this work, the same rationale is presented in Table 2.2 and examples are given for each category. I endorse that this integrative framework is lacking in public policy to evaluate the (relative) effectiveness of different incentives often used indistinctively. Although the literature is populated with strong theoretical concepts and numerous empirical regularities, to date it it is not clear which type of interventions works better in which situation for which people. Striving for evidence-based policy is designing

well-designed studies testing comparative intervention effects – preferably informed by behavioural principles which may help to clarify the underlying processes involved in behaviour and shed light on unexpected or adverse effects found. This work will make a modest contribution to achieve this goal, by looking at the role of incentives used as positive reinforcers to promote health behaviour.

	Reinforcement	**Punishment**
Positive	Interventions that reward patients for health care compliance or blood donation ***Conditional cash transfers, gifts, lotteries or vouchers***	Interventions that punish patients with sanctions, penalties or fees for lack of compliance with health care or blood donation *Likely to be difficult to implement for both compliance and blood donation due to ethical criticisms*
Negative	Interventions that reduce patients' costs with health care compliance or blood donation ***Reimbursement of fees, free screening, transportation included, prepaid postage***	Interventions in which there is an initial endowment and patients experience deductions for each missed compliance or blood donation appointment *Difficult to implement for blood donation* ***Commitment devices with loss of deposited funds; withdrawal of welfare benefits***

Table 2.2 Financial incentives according to operant conditioning principles

Chapter 3

Incentivising Blood Donation: Was Titmuss Right?

Titmuss hypothesized that (i) paying blood donors would reduce the quality of the blood donated and (ii) would be economically inefficient. I report here the first systematic review and meta-analysis to test his hypotheses, reporting on both financial and non-financial incentives. Studies deemed eligible for inclusion were peer-reviewed studies that presented data on the quantity (as a proxy for efficiency) and quality of blood donated comparing people who donated blood when offered an incentive and those donating blood with no offer of an incentive.

Electronic and hand searches were performed in the main databases from inception to 2013. Eight experimental studies (about blood quantity) and 13 observational studies (about blood quality) met the inclusion criteria. The included studies in the meta-analysis for quantity of blood involved 93,328 participants. No meta-analysis was performed for observational studies.

Based on the small number of papers found, incentives had no impact on the likelihood of donation. Subgroup analyses suggest that there was no difference between financial and non-financial incentives in the quantity of blood donated, although the number of papers involved is too small for this conclusion to be meaningful. Of the two experimental studies that assessed quality of blood, one found no effect and the other found an adverse effect from the offer of a free cholesterol test ($\beta=0.011$ $p<.05$). The observational studies suggest that offering financial incentives for blood increases the chances of transfusion-transmissible infections unless payments are contingent upon blood quality. This evidence suggests that Titmuss' hypothesis of the economic inefficiency of incentives is correct. There is insufficient experimental evidence to assess the impact of incentives on the quality of the blood provided but observational data cautions against a possible adverse effect.

3.1 The lasting impact of *The Gift Relationship*

The empirical analysis in this work starts with blood donation. This chapter is dedicated to examining the impact of offering financial incentives to increase blood donation, testing Titmuss' hypotheses for both quantity and quality of the blood donated. I report here the first systematic review to test these hypotheses, reporting on both financial versus non-financial incentives and the impact of incentives on first-time donors versus previous donors.

This topic of paying for blood has been heavily debated since *The Gift Relationship* (1970) by Richard Titmuss, which became the seminal work against paying for blood. *The Gift Relationship* (1970) is mostly a reflection about the role of altruism in modern society, attempting to reconcile economic policy with the morality[1] of individual action. Blood donation takes the central stage as a metaphor for the questions that society should preserve from the "*language of price elasticity and profit-maximisation"* because this type of reasoning may have *"far-reaching implications for human values and all social service institutions*" (p.220).

Titmuss draws on the contrast between the US blood supply system (mostly dependent on paid donors) and that in the UK (based entirely on unpaid donors), comparing the characteristics of blood donors, national statistics for blood supply and demand, and surveys of donors' motivations. The book's core premise is that altruistic blood donations are superior to a commercial provision of blood on the grounds of blood quality, economic efficiency and moral value. Titmuss's prediction that payment would decrease blood quality was based on numerous reports by US doctors of blood obtained from those with drug addictions and infectious diseases who successfully concealed their condition. In a market context, blood donors are motivated to withhold information about their health status as this disclosure may affect the price offered for their blood or even disqualify them as blood donors.

Contrary to common belief (e.g., Chmielewski et al, 2012; Mellström & Johannesson, 2008), Titmuss did not predict that blood quantity would decrease if incentives were introduced. He did, however, consider the economic efficiency of paying for blood and the cost per unit of blood, which he claimed was higher in countries that paid donors because of a higher waste of blood and administrative costs. Blood quantity can be

[1] It is not my intention to trigger a discussion about morality as it is such a complex construct outside the scope of this work. Any references to the concept 'moral' or 'morality' were used in reference to Titmuss' own designations. According to Titmuss (1970), his work is about "*the morality of individual wills*" and "*a moral choice to give in non-monetary forms to strangers*" (page 59).

taken as a proxy for efficiency because, given the same amount of blood, the cost per unit from a paid source is higher than that from an unpaid source. In this review I will take the likelihood of donation as a proxy for economic efficiency of incentivised donations.

These arguments raised a heated discussion, particularly among economists, with criticism of Titmuss for his narrow view of market forces and lack of empirical support (Arrow, 1972; Solow, 1971). Proponents of the free-market for blood supply formulated the hypothesis that paying donors for blood would increase supply, based on earlier analyses (Cooper & Culyer, 1968).

But most importantly for Titmuss - and the most well-known feature of his work - is his defence of the superior moral value of altruistic blood donations compared to paid donations. He argued that decreasing the opportunity for altruistic donations with the offer of payment could have unpredictable negative consequences by limiting people's freedom to give out of regard for the needs of others. Although this assumption was not based on empirical evidence, he presented survey data suggesting the negative impact of incentives in the former Soviet Union showing that after incentives were introduced, only 72% of donors reported they would keep donating if payments were withdrawn and only 50% of donors would donate as often as they currently did.

It is important to emphasize that this survey data was the only evidence backing Titmuss in the formulation of his arguments. Titmuss neither showed that financial incentives have a detrimental effect in blood donation nor proved that paying for blood decreases the quality of blood supplied. He presented his hypotheses, grounded in a humanistic view of the role of Social Policy as a building block of a better and more cooperative society. If a price could be attributed to blood – as a metaphor for the deepest human values – Social Policy would be nothing more than economic policy.

Despite the paucity of evidence presented in his book, Titmuss' idealistic ideas influenced blood acquisition policies on a global level. From 1975, the WHO has defended nonpaid blood donations and in 2009 strongly reinforced this stance with the Melbourne Declaration on 100% Voluntary Non-remunerated Donation of Blood and Blood Components with the statement that "…*paid donation can compromise the establishment of sustainable blood collection from voluntary non-remunerated blood donors*" (WHO, 2009 p2). Most blood agencies worldwide follow the WHO guidelines (Domen, 1995).

Substantiating the endorsement for voluntary donations, the majority of nonclinical research about blood donation focus on understanding the personal and contextual factors associated with blood donation – and not clarifying the role of financial incentives.

Research has mostly been directed at identifying the barriers that prevent individuals from donating blood and the proposed interventions make an effort to divert these hurdles (Conner et al, 2013; France et al, 2011; Holly et al, 2012).

The most common barriers reported by individuals are (1) fear of the blood donation procedure e.g., needles, possible fainting, (2) scheduling difficulties and (3) lack of motivation to donate blood (Ferguson et al, 2007). Interventions to tackle (1) target people who have already decided to donate and aim to make the donation experience more enjoyable. These interventions are based on distraction, minimisation of muscle tension and fluid intake (e.g., Ditto et al, 2003). Interventions aiming to tackle (2) scheduling difficulties and (3) lack of motivation to donate blood has been mainly influenced by psychosociological reasoned actions models, primarily the theory of planned behaviour (Ajzen, 1991). Research in this stream includes mostly cross-sectional studies, examining how cognitive and motivational variables increase an intention to donate – working under the assumption that intentions will lead to behaviour. The extensive studies analysing the role of the theory of planned behaviour variables have shown that attitudes, perceived behavioural control and subjective norms, all positively influence the intention to donate (Bednall et al, 2013). The theory of planned behaviour is often supplemented with additional variables such as self-efficacy or past donation behaviour that significantly increase the predictive value of the model to predict donation intentions (Ferguson et al, 2008).

The role of helping motivation and altruism has also been comprehensively analysed. Survey evidence of donor motivation indicates that donors report altruistic reasons to donate (Masser et al, 2008). Public service announcements using motivational interventions to promote altruism and to model pro-social behaviour vicariously tend to manipulate emotional appeals (Ferguson et al, 2007). These messages either emphasise the values of humanity or promote messages of societal duty to help others. Godin and colleagues (2011) performed a meta-analysis of the interventions to promote blood donation and reported that altruism-based interventions are the most effective strategies to increase blood donation.

However, Godin and co-workers (2011) did not include in their meta-analysis the effect size of incentives. Only two studies on incentives were included in their review (Ferrari et al, 1985; Jason et al, 1986) and the authors concluded it was not possible to make any claim about the impact of incentives from a couple of studies. The only other review about the impact of incentives on the likelihood of giving blood is from Goette and

co-workers (2010). The results of this unsystematic, narrative review led the authors to conclude that incentives work well in increasing blood supply.

The research reviewed to this point targeted the analysis of blood donation rates. The quality of the blood donation is a subject that has attracted much less attention in the literature. There are only two reviews strictly grounded on observational studies, which report a higher prevalence of transfusion-transmissible viruses in blood acquired from paid donors (Eastlund, 1998; Van Der Poel et al, 2002). In line with these findings, a more recent study from Lithuania assessing both regular and first-time blood donors found that blood from first-time paid donors was of poorer quality (Kalibatas, 2008).

Thus, although Titmuss' views about paying for blood shaped public discussion and policy making worldwide, the limited available evidence does not reflect the significance of his influence and there was never a clear empirical assessment of his premises. To date, there is no conclusive evidence of the impact of offering incentives for blood. I will contribute to the literature with first systematic review and meta-analysis to assess the impact of offering financial incentives upon the quantity and quality of blood supplied.

3.2 Nonmonetary incentives and crowding-out

As extensively discussed in chapter 2, Titmuss's manifesto for altruistic blood donation marked the start of wide-scale discussions about perverse effects of incentivizing behaviour that became known as motivational crowding-out (Promberger & Marteau, 2013). *The Gift Relationship* is an enduring reference in the discussion about incentives in the context of blood donation (Frey 1997; LeGrand, 2003; Promberger & Marteau, 2013). However, the discussion about detrimental effects of paying for blood has always been predominantly associated with financial incentives per se (cash) (Newman & Shen, 2012). The widespread idea that paying for blood could have unpredictable negative consequences raised the question of what comprises payment and where a distinction may lie between financial incentives as cash or lotteries and non-financial incentives as t-shirts, mugs, medical tests or days off work (Lacetera & Macis, 2013). The former tends to raise more opposition whereas the latter is more commonly accepted as a legitimate way to incentivize blood donation (e.g., Buyx, 2009; Mortimer et al, 2013; Sass, 2013). Interestingly enough, this intensive debate occurs without the hypothesis of crowding-out having ever been proved.

Some studies focus on blood donors' altruistic self-identity and how the offer of monetary rewards could conflict with such identity and therefore have a negative effect on individuals' altruistic motivations (Costa-i-Font, 2013; Lacetera & Macis, 2010a). Although I do not explicitly approach the matter of identity in my work, I consider that this debate falls within the larger question about whether economic and noneconomic motivations work as complements or substitutes in prosocial behaviour (Bowles & Polania-Reyes, 2012). The discussion about intrinsic motivation and crowding-out effects complements to a large extent the debate about donors' altruistic self-identity and its (negative) interaction with financial rewards. Ultimately, the existence of crowding-out effects suggests the people were unwilling to trade-off their altruistic identity for their financial self-interest. Whether this altruistic self-identity is based on 'pure' motives or an image motivation may be irrelevant because both can be internalised and thus, become part of donors' motivational orientations

Most research about the impact of different types of incentives on blood donation comes from observational studies. Sanchez and colleagues (2001) analysed the preferences of 7489 donors who responded to an anonymous mail survey. They estimated that offering blood credits and medical testing would lead – respectively - to 58% and 46% of donors to return. A gift of small value would only motivate 20% of donors. Younger donors reported a higher preference for incentives than older donors. Using a similar design, Glynn and co-workers (2003) showed that the incentives most likely to encourage return among 45,588 donors were blood credits (61%), cholesterol screening (61%), and prostate-specific antigen (PSA) screening (73% of men). Younger donors (≤25 years old) were 4 to 5 times more likely to report a willingness to donate if offered compensatory incentives (tickets to events, discounts or lottery and/or raffle tickets, gifts) than donors older than 55. About 10% of all donors reported they would be discouraged to return if offered compensatory incentives. More recently, in a survey to 467 blood donors in an Italian town, Lacetera and Macis (2010) found that donors reported they would stop being donors if given 10 Euros in cash, but not if a voucher of the same nominal value was offered instead.

However, these observational studies share a self-selection bias limitation because these results are strictly based on the answers of current donors. The study by Costa-i-Font and colleagues (Costa-i-Font et al, 2013) is an exception to this pattern. The authors analyzed the attitudes toward payment for blood in large representative samples of 15 European countries and concluded that those in favour of paid donations were less likely to

have donated blood, while those favouring non-monetary rewards were more likely to be donors.

Hence, research about the impact of different types of incentives has mostly discussed around financial versus nonfinancial incentives but is restricted to studies examining self-reported data. I will contribute to this discussion, also by comparing the effectiveness of financial versus nonfinancial incentives, but this time based on evidence from randomised controlled trials.

3.3 Hypotheses

Meta-analysis does not provide a test of hypotheses *strictus sensus*; even though the meta-analysis on quantity of blood only includes randomised controlled trials, by aggregating evidence and reporting summary effects, it provides estimates based on observed patterns. Thus, no causality can be drawn from its results. Nevertheless, a meta-analysis provides a full grasp of the empirical literature and quantifies behavioural regularities.

Having acknowledged the boundaries of meta-analysis, I reinstate that a fundamental aim of this study is to test Titmuss' hypotheses about blood donation. He proposed two main hypotheses: (1) financial incentives are economically inefficient and (2) financial incentives will decrease blood quality by attracting new at-risk donors and alienating voluntary healthy donors.

I will operationalise hypothesis 1 taking the likelihood of donation as a proxy for economic efficiency. With respect to Titmuss' prediction about blood quality, it may be difficult to assess if changes in blood quality are driven by an alienation of healthy volunteers and/or an increase of donors with poorer health. Thus, I will separate the two topics involved in his prediction. On one hand, I will compare the overall quality of the blood donated when incentives are present versus absent (hypothesis 2). On the other hand, Titmuss proposed that the income level of donors could determine their willingness to donate blood upon the offer of an incentive. He anticipated that incentives could attract more deprived donors which would have a higher need to exchange blood for money. I operationalise this assumption as hypothesis 3.

Hypothesis 1: Financial incentives will not increase the quantity of blood donation.

Hypothesis 2: Financial incentives will decrease blood quality.

H3: Financial incentives will increase the quantity of blood donated by low income individuals.

Research after Titmuss motivated the following hypotheses. On one hand, many scholars assuming the reality of the crowding-out hypothesis, proposed that nonmonetary incentives could avoid the adverse effects of financial rewards (Lacetera & Macis, 2010; Lacetera et al, 2013; Costa-i-Font et al, 2013). I propose hypothesis 4 to test the validity of this assumption. The same line of reasoning that proposes nonfinancial incentives as more effective than cash (Sass, 2013*;* Lacetera et al, 2013; Costa-i-Font et al, 2011) also proposes that incentives should be 'symbolic' (Lacetera & Macis, 2010b), which suggest low incentive sizes (hypothesis 5).

H4: The quantity of blood donated will increase when donors are offered nonfinancial incentives but not when they are offered financial incentives.

H5: The quantity of blood donated will be negatively related to incentive size.

Interestingly, there has been no debate about how the characteristics of the incentive offer (type and size) influence the quality of the blood donation. This discussion has been circumscrite to the likelihood to donate blood. I am also interested in analysing the same hypotheses 4 and 5 about the impact of type and size of incentive in the quality of the blood donated.

Based in the psychological literature about motivational crowding-out, I also predict that people with low baseline levels of intrinsic motivation are expected to respond positively to the offer of an incentive (Deci et al, 2001; Deci & Ryan, 1985). I take donor experience (first-time vs. previous donors) as a proxy for donor motivation (Promberger & Marteau, 2013). Thus, I predict that incentives will be effective to increase blood donation only in first-time donors i.e., with low baseline motivation levels.

H6: Financial incentives will increase the quantity of blood donated for first-time donors but not previous donors.

3.4 Method

The Cochrane Review handbook was used to guide the methods employed in this review (Higgins & Green, 2011) – although neither this review nor the next review (chapter 4) were registered with Cochrane Collaboration.

3.4.1 Inclusion and exclusion criteria

The inclusion criteria were (a) published studies in which participants in one group were offered an incentive for blood donation and in another group were not, and (b) that reported data on one or both of two outcomes: the proportion of people providing blood; and, the quality of the blood provided. Incentives were defined as a good or service with a monetary value offered in exchange for blood. These could be described as compensation for resources spent in donation (most usually time) or as an explicit motivator. Exchanges of little or no monetary value such as certificates, medals or badges were excluded. An inclusion criterion for studies to be included in meta-analysis was an experimental design i.e., observational studies were not included in meta-analysis, only included in a narrative review.

3.4.2 Data sources and searches

Initial electronic searches were performed in MEDLINE (1950 to December 2011), EMBASE (1980 to December 2011) and PsycINFO (1985 to December 2011) using OVID SP, and CINAHL (1982 to December 2011) via EBSCO. The search strategies used both keywords and medical subject headings (Appendix B). I also searched for relevant systematic reviews in the Cochrane Central Register of Controlled Trials (CENTRAL, the Cochrane Library, December 2011) as well as the OVID SP databases (1985 to December 2011), EconLit via EBSCO (1996 to December 2011), JSTOR Health and General Science Collection (1886 to December 2011 in Economics) and Google, using terms related to incentives and blood donation (search strategy in Appendix 1). The search strategy was repeated in 2013 to identify more recent papers.

3.4.3 Data extraction

Two review authors pre-screened all search results (titles and abstracts) against the selection criteria for possible inclusion, and those selected by both review authors were subjected to a full-text assessment. Both authors independently assessed the selected full-

text articles for inclusion, resolving any discrepancies by consensus. Variables of interest included study participants, study design, incentive, outcome measure and results.

3.4.4 Data synthesis and analysis

For the meta-analysis, the effect size is reported using odds ratios (OR), with an OR greater than one favouring the intervention group. Pooled effect sizes were obtained with 95% confidence intervals using a random effects model. Study heterogeneity was examined with subgroup analyses but not random-effects meta-regression due to the small final sample size. Data analysis was performed using the Cochrane RevMan 5.1 software for meta-analyses.

3.4.5 Assessment of Risk of Bias

Risk of bias was assessed by two authors in accordance with the guidelines of the Cochrane Consumers and Communication Review Group (Higgins & Green, 2011) which recommends the explicit reporting of individual elements that affect risk of bias, including:

1. Sequence generation: classified as adequate if carried out using true randomization and not quasi-randomization, such as by day of week, date of birth or sequence;
2. Allocation concealment: classified as adequate if allocation is concealed from the purveyor of risk information, researchers and the participant at least until the point of allocation to groups;
3. Blinding: classified as adequate if participants, personnel and outcome assessors are blind to allocation.
4. Incomplete outcome data: classified as adequate if attrition data are clearly reported and there is no evidence of differential drop out in the intervention and control groups;
5. Selective outcome reporting: classified as adequate if data are provided for all outcomes specified in the study protocol, or where this may be unavailable, in the methods section;
6. Other sources of bias, including baseline comparability: classified as adequate if groups are comparable at baseline or any differences at baseline are adjusted for in the primary analysis; and validation of measures, classified as adequate if there is evidence of reliability and validity reported in the study or published elsewhere.

3.5 Results

The initial search yielded 1100 abstracts, which resulted in 89 full papers being assessed for eligibility (Figure 3.1). The large number of papers excluded at the screening stage was mostly due to the retrieval of clinical trials that assessed quality of blood donated but not based on the offer of incentives.

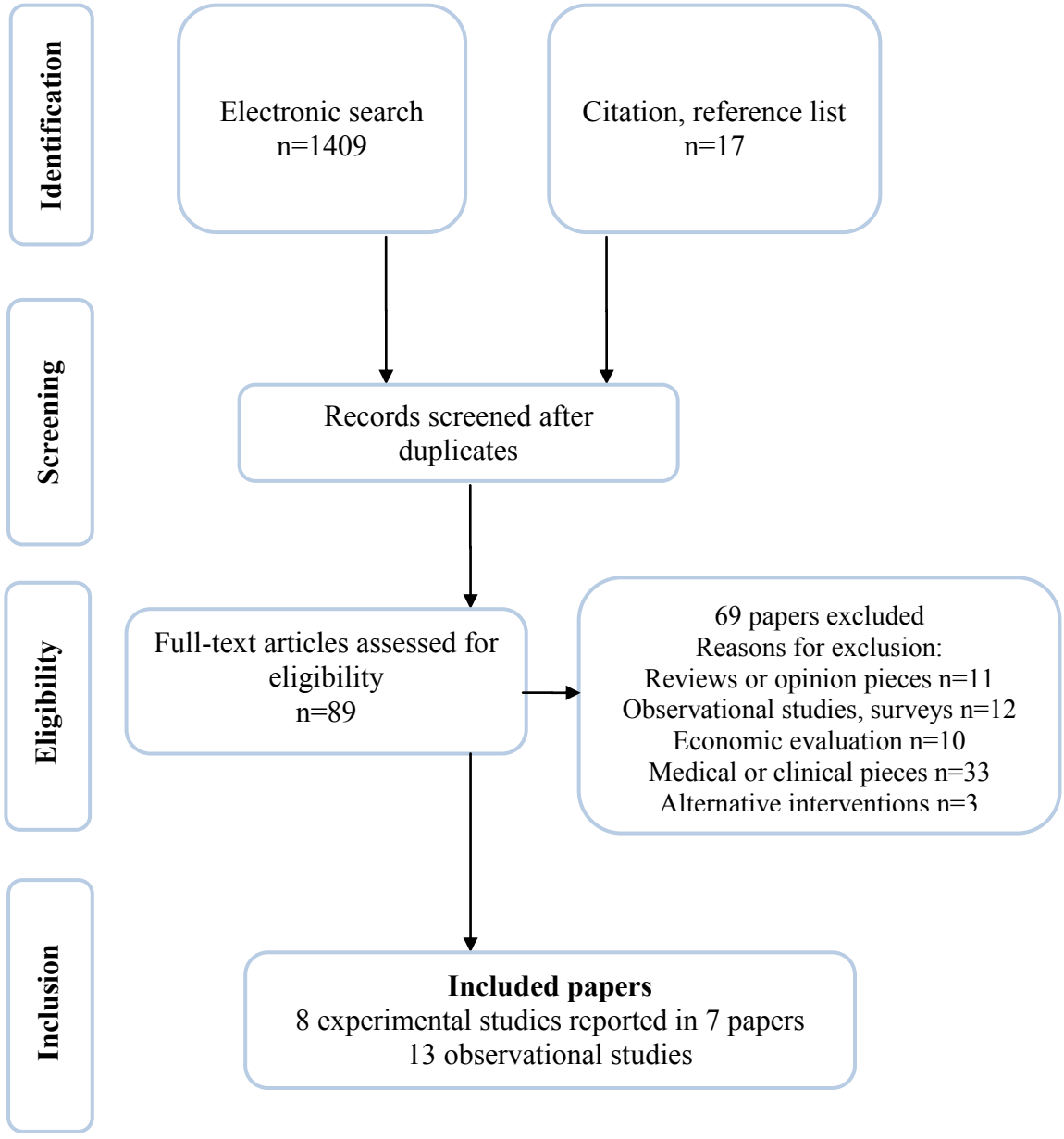

Figure 3.1 PRISMA flow chart for blood donation review

Seven papers, reporting eight experimental studies (Goette et al, 2009 presented two studies in the same paper), met the eligibility criteria for the meta-analysis. These papers were mostly about the quantity of blood donated. With respect to the quality of the blood donated, 13 observational studies were included but for which only a narrative appraisal will be performed.

3.5.1 Quantity of blood donation

The included studies assessed the impact on the likelihood of donating following the offer of a financial incentive. There are **seven papers** (Table 3.1) with data about quantity of blood donated included in **eight experiments** – a paper presented two experiments (Goette et al, 2009). However, it was only possible to pool data for the meta-analysis from six of the eight studies. Two studies did not report data in a form that could be extracted for meta-analysis (Goette & Stutzer, 2008; Goette et al, 2009 Study 2). Requests to the authors for the data in an extractable form were unsuccessful.

Of the six experiments included in the meta-analysis, three were conducted in the US, one in Switzerland, one in Sweden, and the other in Argentina. Two involved strictly previous donors, two involved strictly first-time donors, one comprised both types of donors and the last one did not specify this information. The incentives offered were varied from coupons for entertainment events (Ferrari et al (1985), a t-shirt (Reich et al, 2006), cash (Mellström & Johannesson, 2008), free cholesterol test (Goette et al Study 1), nonspecific gift cards (Lacetera et al, 2012) and supermarket vouchers (Iajya et al, 2013). The value of the incentives was not always specified but is estimated between $3 and $23. These six studies involved 93,328 participants with an age range from under 20 to 65. The gender mix amongst participants ranged from 39% to 60% women.

Authors	Country	Participants & Setting	Type of donor	Groups	
				Control Group	**Incentive Group**
Ferrari et al (1985)	US	Posters and bulletins posted around a US University campus with announcement about time and place of blood donation	Both first-time and previous donors	n=31 Peer altruism Students were informed that their peers would be donating blood	n=49 Offer of coupons redeemable at local merchants for free or reduced-price merchandise and a raffle (tickets to Broadway play, college football game)
Reich et al (2006)	US	Blood Centres in San Francisco and Arizona; Outcome second and third donations of first-time donors within 6 months	Previous donors	n=3,441	n=3,478 Offer of a t-shirt
Mellström & Johannesson (2008)	Sweden	Regional Blood Centre Gothenburg Sweden; Primary outcome health check for blood donation	First-time donors	n=89	n=85 Offer of $7 n=88 Choice between $7 and donation to charity

Goette & Stutzer[2] (2008)	Switzerland	Zurich Blood Donation Service of the Swiss Red Cross; individuals registered in the database invited to donate blood again	Previous donors	n=2,950	n=4,431 Offer of a free cholesterol test n=1205 Offer of a lottery ticket from Swiss State Lottery
Goette et al (2009) Study 1	Switzerland	Zurich Blood Donation Service of the Swiss Red Cross	First-time donors	n=725	n=1,400 Offer of a free cholesterol test
Goette et al (2009) Study 2[2]	Switzerland	Zurich Blood Donation Service of the Swiss Red Cross 8269 previous donors	Previous donors	n=1,968	n=3,812 Offer of a free cholesterol test
Lacetera et al (2012)	US	The American Red Cross (ARC) conducted 14,029 blood drives in US northern Ohio between May 2006 and October 2008	Previous donors	$5 N=10,846 $10 N=12,515 $15 N=12,607 Total N=35,968	$5 N=17,847 $10 N=15,849 $15 N=12,738 Total N=46,434

[2] Papers shaded in red were not included in the meta-analysis because the authors did not provide the raw data of the studies

					The different amounts refer to gift cards redeemable for food, gasoline and general merchandise.
Iajya et al (2013)	Argentina	18500 individuals randomly selected from electoral lists under 65 years old	Unclear	N=2360	$5 N=2253 $14 N=2336 $23 N=3264 Supermarket vouchers

Three experiments tested more than one incentive in the same study (Mellström & Johannesson, 2008; Lacetera et al, 2012; Ijaya et al, 2013). As these observations are not independent, the results from only one incentive condition per study are included in the meta-analysis. For Mellström and Johannesson (2008) we include the results from the offer of the fixed incentive (and not the offer of a choice between an incentive and a donation to charity), thus making the intervention more comparable to other interventions in the review. In Lacetera et al (2012), three sizes of incentive were offered ($5, $10, $15). Similarly, Iajya and colleagues (2013) tested the impact of supermarket vouchers valued $5, $14 and $23. I report the results from different meta-analyses using the lowest, medium and highest values from each study. But I only present the meta-analysis forest plot (Figure 3.2) using the highest incentive because it provided the more conservative estimate.

In Lacetera et al (2012) I could not access the raw data for the control group (no incentive). However, the authors had data from blood drives in which donors were not informed that gift cards would be offered upon donation – designated 'surprise' drives. Thus, I use data from these drives as a control because participants were unaware that there was a reward and, therefore, their behaviour cannot be attributed to the incentive.

Two of the studies presented in Table 3.1 were cluster randomised trials, in which different incentive were offered in different blood drives (Goette & Stutzer, 2008; Lacetera et al, 2012). Given that the former was excluded for the lack of access to raw data, only the latter was adjusted for its cluster randomization. The odd ratio was adjusted through the ratio estimator approach by Rao and Scott (1992 in Donner & Klar, 2002). This simple approach requires that the observed sample frequencies (counts) in a given study be divided by the estimated design effect, after which standard statistical methods may then be applied as usual to the adjusted data. The study did not provide information about its estimated design effect so this was calculated following Donner and Klar (2002): for trials randomizing clusters of average size m to two or more intervention groups, this factor can be estimated approximately by $1+(m-1)\rho$, where ρ is the sample estimate of the intracluster correlation coefficient (ICC). ICC was set at .05 assuming similarity between the clusters (blood drives) randomised in the studies. The raw data for Lacetera et al (2012) is shown at the bottom of Figure 3.2. For each incentive value, the overall sample size was divided by the number of blood drives in which that specific incentive was offered, providing the estimate for m, the average size of each cluster. The adjusted raw data is presented at the top of Figure 3.2.

In the six studies included in the meta-analysis (Figure 3.2), the likelihood of blood donation did not change with the offer of an incentive (OR=1.54 p=.19). This estimate is based on using the highest incentive value from both Lacetera et al (2012) and Iajya et al (2013), $15 and $23 respectively. Results are not altered by including any of the other incentive sizes from Lacetera et al (2012): $5 (OR=1.22 95% CI 0.91-1.63 p=.19), $10 (OR=1.33 95% CI 0.94-1.89 p=.11) and from Iajya et al (2013): $5 (OR=1.02 95% CI 0.11-1.23 p=.59), $14 (OR=1.13 95% CI 0.14-1.39 p=.31).

There was evidence of between-study heterogeneity (I2=72% χ^2=18.04 p=.003). There was no sign of a small-study effects (Egger's test=1.51 p=.132) and Begg's test for publication bias was not significant (z=.98 p=.327). Study estimates show no pattern by publication year.

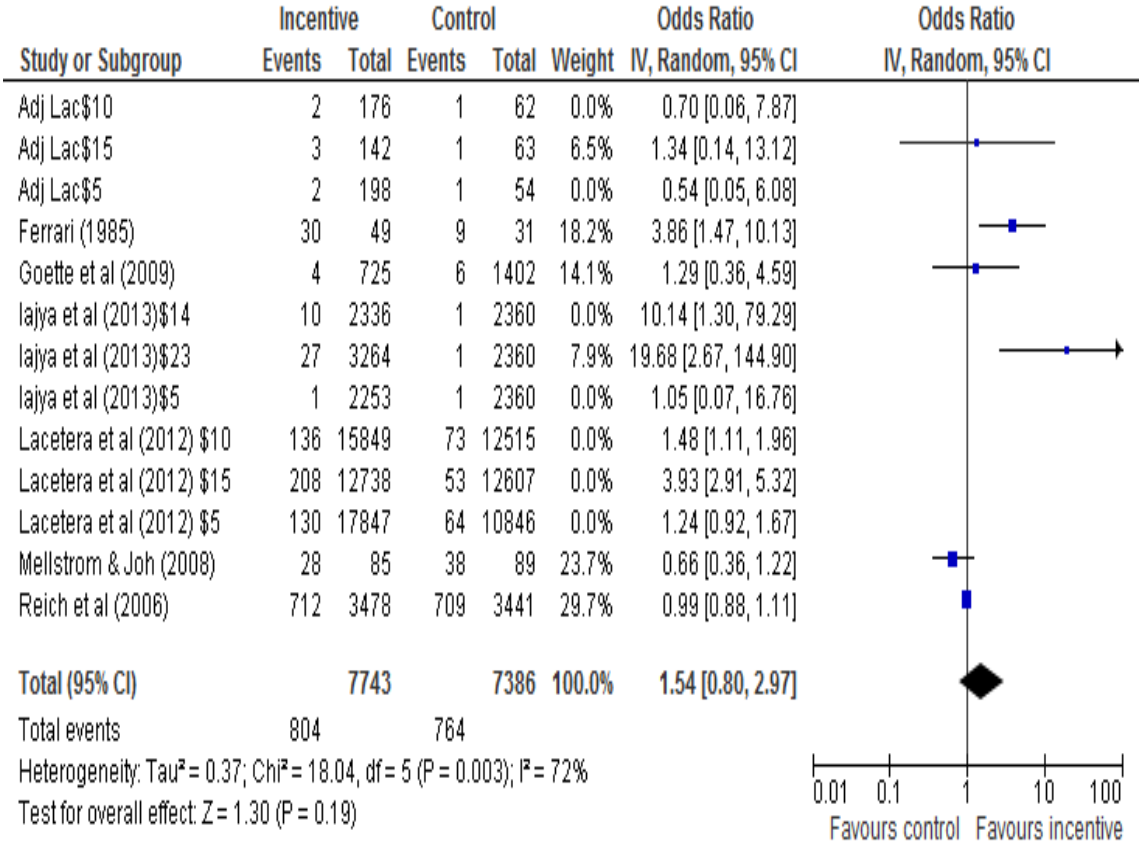

Figure 3.2 Impact of financial incentives upon likelihood of providing blood [note: only data from one subgroup ($15) in Lacetera et al (2012) and one subgroup ($23) from Iajya et al, 2013) are entered into this meta-analysis]

However, results from Ferrari et al (1985) and Mellstrom and Jonhassen (2008) (1) are susceptible to self-selection bias because the participants in these studies were not randomly recruited and (2) have very small sample sizes. These methodological limitations have been raised as explanations for the lack of evidence for a positive impact of incentives in blood donation (Lacetera et al, 2013). Nevertheless, even after removing these two studies from the analysis and keeping only the studies with adequate randomisation and large sample sizes, the overall estimate remains unchanged (OR=1.85 p=.26) (Figure 3.3). This estimate does not change if the incentive sizes from Lacetera et al (2012) and Iajya et al (2013) in the analysis are low (OR=.09 p=.93) or medium (OR=.91 p=.36).

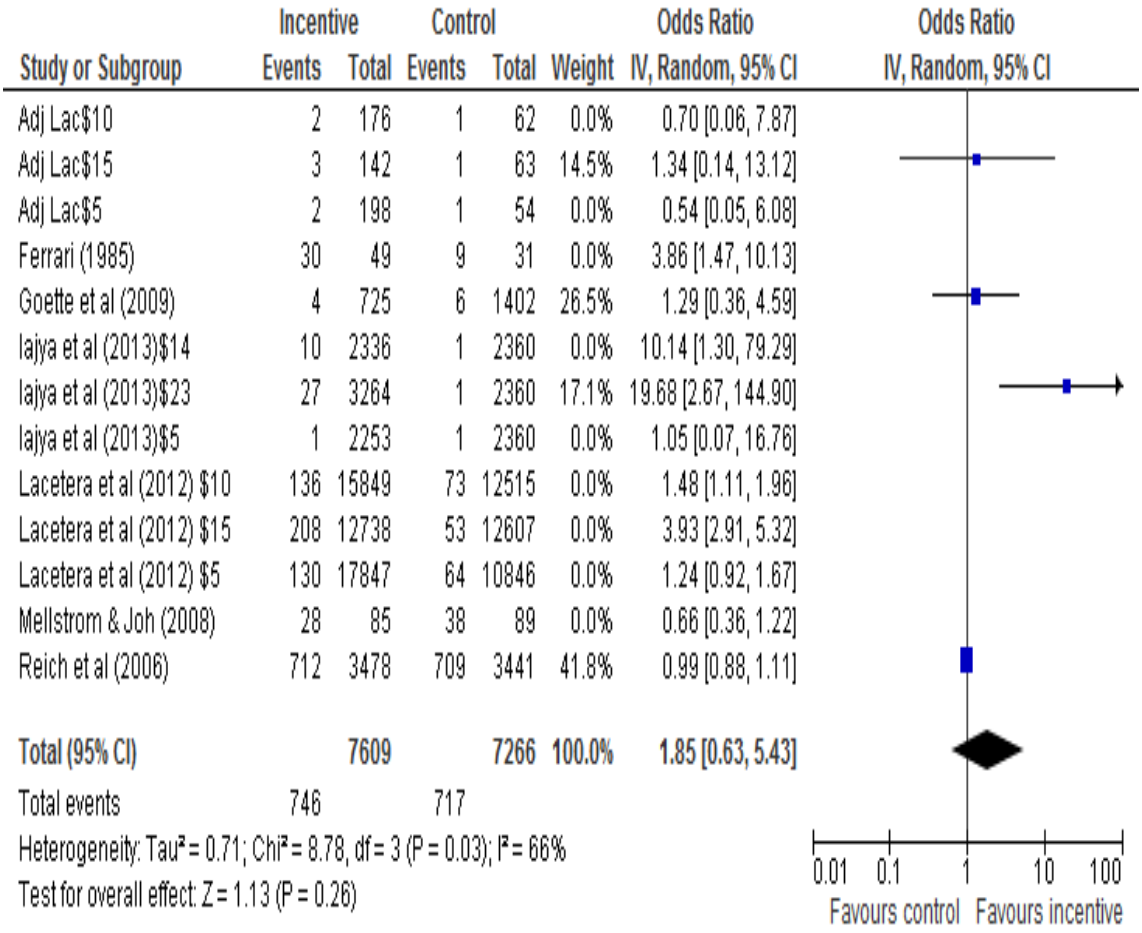

Figure 3.3 Impact of financial incentives upon likelihood of providing blood for high quality studies [note: only the highest subgroup ($15) in Lacetera et al (2012) and in Iajya et al (2013) ($23) are entered into this meta-analysis]

In both studies that could not be included in the meta-analysis, individuals in the experimental groups were offered a free cholesterol test as an incentive which had no impact on the likelihood of providing blood in either study (Goette & Stutzer, 2008; Goette et al., 2009 Study 2). In one study (Goette et al., 2009) a lottery was offered to a second experimental group. This had no main effect but amongst donors with a previous low rate of donation, it increased the likelihood of donation (by an estimated 9%), with no impact on those with previously high rates of donation.

Taken together, these results **support hypothesis 1,** stating that financial incentives will not increase blood donation.

Hypothesis 2 will be tested in the next section (about blood quality) and there was no information about the income level of donors and thus **hypothesis 3 could not be tested**.

The number of included studies was too small to perform meta-regression analysis to test the remaining hypotheses. Nevetheless, I present data from subgroup analyses that shed light on the hypotheses proposed for this study. These estimates, however, are interpreted mostly as tendencies.

Based on very small subgroup analyses, none of the incentive types seemed to be effective: cash OR=1.14 p=.67 95% CI .63-2.07 (n=1), *vouchers OR=2.13 p=.11* 95% CI .85-5.31 (n=3) and gifts OR=.99 p=.92 95% CI .89-1.12 (n=2). Hypothesis 2 proposed that the quantity of blood donated is higher when nonfinancial (but not financial) incentives are offered. **Hypothesis 4 cannot be supported.**

Small incentives valued <=$5 ($3 Reich et al, 2006; Lacetera et al $5; Iajya et al $5) did not significantly increase blood donation (OR=0.99 95% CI 0.88-1.11 p=.87) and neither did medium size incentives valued]$5, $15[(OR=1.27 95% CI 0.45-3.60 p=.65 including $7 Mellstrom and Johannesson, 2008; Lacetera et al $10; Goette et al, 2009 $13 and Iajya et al, 2013 $14). But also taking strictly the two experimental groups using higher incentives (Lacetera et al, 2012 $15 and Iajya et al, 2013 $23) the estimate is still not significant (OR=5.44 95% CI 0.39-75.67 p=.21). **Hypothesis 5** testing a preference for low incentives **is not supported**.

Further subgroup analyses similarly showed no difference when participants were first-time donors (OR=1.16 p=.58) or when they were previous donors (OR=1.06 p=.57). **Hypothesis 6 is also not supported**: incentives do not have a differential impact according to donors' experience.

3.5.2 Assessment of risk of bias

Table 3.2 presents the assessment of risk of bias for included experimental studies examining quantity of blood donated. The pattern of findings suggests a moderate risk of bias from a failure in any study to specify methods of randomization, and those assessing outcomes not being blind to group allocation. Nevertheless, I show that my result holds even when restricting the analysis to higher quality studies (Figure 3.3). All studies had adequate presentation of outcome data. Two studies were excluded from meta-analysis because they did not present their outcome data in a format that could be used to extract information for meta-analysis (Goette & Stutzer, 2008; Goette et al, 2009 Study 2) but the reporting of the data in each of these paper was properly presented. There was no evidence of selective reporting or other noticeable sources of bias.

Study	Sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Selective reporting	Other sources of bias
Ferrari et al (1985)	Unclear - "10 female volunteers were instructed to randomly use one of two strategies" p.792	Researchers aware of allocation to groups	Only participants blind to allocation	Adequate	Adequate	Adequate "no difference existed between (…) conditions in sex and donation history"
Reich et al (2006)	Unclear - "each donor had an equal chance of being randomized into groups" p.1091	Recruitment staff aware of allocation to groups	Only participants blind to allocation	Adequate	Adequate	No baseline comparison
Mellström & Johannesson (2008)	Unclear – "participants were randomly allocated into three groups" p.848	Unclear	Unclear - participants blinded to allocation	Adequate	Adequate	Adequate
Goette & Stutzer (2008)	Quasi - cluster randomization per donation center and per day of week	Adequate Allocation concealed to staff and	Adequate Staff and participants blinded to	Adequate	Adequate	Adequate control of baseline differences

		participants	allocation				
Goette et al (2009) Study 1	Unclear – "treatments were randomly assigned to mail orders" p.527	Unclear	Participants blinded to allocation	Adequate	Adequate	Adequate control of baseline differences	
Goette et al (2009) Study 2	Unclear – "randomly invited" p.527	Unclear	Participants blinded to allocation	Adequate	Adequate	Adequate control of baseline differences	
Lacetera et al (2012)	Unclear – "randomly selected"p.17	Researchers aware of allocation, unclear staff	Participants blinded to allocation	Adequate	Adequate	Adequate control of baseline differences	
Iajya et al (2013)	Adequate - Random numbers	Unclear	Participants blinded to allocation	Adequate	Adequate	Adequate	

Table 3.2 Assessment of risk of bias for blood donation studies

3.5.3 Quality of blood donation

Two experimental studies assessed the impact of offering financial incentives to existing donors upon the quality of blood provided as indicated by the rejection rate or donors deferred from donating (Goette & Stutzer, 2008; Lacetera et al., 2012). Lacetera et al (2012) reported that incentives (gift cards) did not change the proportion of rejected donations. The coefficient estimate for an adverse effect on quality was statistically significant for the $10 incentive but not for the $5 and $15. Goette & Stutzer (2008) found no effect on quality of donations following the offer of a lottery ticket but the offer of a cholesterol test increased the proportion of donations rejected (β=0.011 $p<.05$).

In the category of observational studies, 12 descriptive studies presenting 13 data sets were found (Table 3.3), comprising a total of 454,653 participants. Two reviews which specifically evaluated the risk of transfusion-transmitted infection by the introduction of financial incentives were the sources of most studies (Eastlund 1998; van der Poel, Seifried et al. 2002). Both reviews report a higher prevalence of lower quality blood i.e., higher infection rates in blood from paid donors. My search strategy identified an additional seven studies eligible for this review (Table 3.3; the papers published after 2001). Of these, two studies using Nigerian blood providers (Ejele, Nwauche et al. 2005; Erhabor, Ok et al. 2007) could not be retrieved and were therefore excluded from the review.

I will not perform a meta-analysis using these studies for several reasons. Firstly, the observational research design of these studies may lead to spurious results. Secondly, the units of observation differ. Some studies report outcomes by number of individuals whereas others report outcome by units of blood. Because each individual is able to provide more than one unit of blood, unit measures may reflect higher infection rates. Lastly, these observational studies examining the quality of the blood donated are neither specific about features of the incentives offered (type of size) nor about the characteristics of the patients. In the words of van der Poel and colleagues (2002): "*definitions of paid and unpaid donors have often been disputed. However, for the sake of this assessment (...) it is feasible to compare the categories just as given by the authors of the studies, acknowledging that some difference in remuneration of the two donor categories must have been present (...) the population categories compared are simply refereed to as paid or unpaid*" (p. 288).

				% of poor quality blood	
Study	**Country**	**n**	**Sample Type**	**Incentive Group**	**No incentive Group**
Jeremiah et al. (2008)	Nigeria	300	people	6.35 [12/189]	2.7 [3/111]
Kalibatas (2008) – A	Lithuania	25,469	units	4.86 [705/14,496]	2.74 [301/10,973]
Kalibatas (2008) – B	Lithuania	71,057	units	0.21 [132/62,398]	0.07 [6/8,659]
Erhabor et al. (2006)	Nigeria	1,500	people	0.77 [5/651]	0.24 [2/849]
Kretschmer et al(2004)	Germany	265,757	units	0.001 [2/179,426]	0.02 [15/86,331]
Durosinmi et al (2003)	Nigeria	16,080	units	2.1 [315/15,007]	0.28 [3/1,073]
Strauss (2001)	USA	51,847	units	0.07 [17/23975]	0.31 [86/27872]
Dille et al (1997)	USA	236	people	60 [30/50]	6.45 [12/186]
Jha et al (1995)	India	594	people	51.03 [99/194]	0 [0/400]
Wu et al (1995)	China	120	people	35 [28/80]	2.5 [1/40]
Strauss (1994)	USA	2,157	people	3.71 [46/1240]	6.98 [64/917]
Dawson (1991)	USA	9,836	Specimen	10.49 [390/3,718]	0.8 [49/6118]
Singh et al (1990)	India	9,700	units	0.24 [4/1700]	0 [0/8000]

Table 3.3 Included observational studies for blood donation

Thus, it is not possible to perform subgroup analyses to test the corresponding hypothesis 4 and 5 with respect to blood quality.

Making a qualitative appraisal of these studies, it is possible to identify that incentives could be given conditionally on blood quality or be unrelated to the quality of the blood provided. Three papers reported evidence on incentives being offered contingent on quality (Kretschmer et al, 2004; Strauss et al, 1994; Strauss, 2001) and suggest that financial incentives positively influenced blood quality while all other papers – in which incentives were offered regardless of quality – report mostly an adverse effect of incentives on the quality of the blood collected. This assessment is consistent with the reviews by van der Poel et al. (2002) and Eastlund (1998): offering financial incentives for blood decreases the quality of the blood supplied unless payments are contingent upon blood quality. The qualitative assessment of these observational studies in combination with the results from the two experimental studies that provided evidence on this matter (Goette & Stutzer, 2008; Lacetera et al., 2012 **partially support hypothesis 2.** Financial incentives seem to increase the likelihood to attract poorer quality blood.

The only evidence about incentive type in the quality of the blood provided is based on a survey to blood donors. Sanchez et al. (2001) surveyed 7489 donors using an anonymous mail survey that inquired about demographics, donation history, infectious disease risks, and the potential appeal of incentives. The authors showed that donors attracted by cash were 60 percent more likely to have a risk for transfusion-transmissible infections ($p = 0.03$), higher than individuals attracted by tickets to events or extra time off work.

No assessment of risk of bias will be performed for the observational studies included in this section. Most tools for quality assessment for observational studies (Sanderson et al, 2007) stress the importance of detailed inclusion criteria and appropriate source population i.e., precise definition of patient characteristics. Given that the studies included are poor in the description of donors and are vague in the definition of paid versus unpaid donors, I consider this evidence as strictly exploratory and suggestive of the effects of incentives in the quality of the blood donated.

3.6 Discussion

In a recent influential paper in Science, Lacetera and colleagues (2013) claim that "*in light of the recent evidence, it is time to re-examine policy guidelines for increasing and smoothing blood supply, including whether incentives can play a role (...) debates on ethical issues around giving rewards for donations should be encouraged. But there should be little debate that the most relevant empirical evidence shows positive effects of offering economic rewards on donations*" (p.928). This bold claim is based on the author's personal narrative appraisal of the literature and their own work, particularly two field studies (Lacetera et al, 2012; Iajya et al, 2013).

However, from the studies that met the eligibility criteria, I found no impact of offering financial incentives on the quantity of blood given. Offering tangible patient financial incentives does not increase the likelihood to donate blood. And this estimate remains unchanged if only high quality studies are included. Therefore, financial incentives are economically inefficient – supporting one of Titmuss main assumptions. This null effect offers no support for motivational crowding-out if operationalised as a lower blood supply when incentives are offered.

The studies were heterogeneous both in terms of the interventions and the populations studied. The incentives offered included t-shirts, cholesterol tests, money, gift cards, lottery tickets and their value varied from $3 to $23, studied in populations from different countries. However, the overall estimate was robust to several sensitivity analyses – incentive size and study quality.

The small number of included studies limited the meaningfulness of subgroup analyses to explore the impact of several potential effect modifiers. My results cannot be taken as solid evidence for the lack of differential impact between financial and nonfinancial incentives. Survey studies (e.g., Costa-i-Font et al., 2013; Lacetera & Macis, 2010a) suggested that non-monetary incentives could be more effective than monetary payments to increase blood donation by avoiding crowding-out effects. Further research is needed to examine the behavioural effects of financial versus financial incentives in actual blood donation rates.

It could be argued that the size of the incentives offered was not sufficient to motivate behaviour. Lacetera et al (2012, 2013) defend that higher incentives could be effective to increase the likelihood to donate blood and endorse that their two field studies demonstrate this effect. However, my results showed that incentives of low

(=<$5), medium (>$5+;$15) and high value ($15+) were equally nonsignificant in increasing blood donations.

A closer look at the papers by Lacetera and colleagues shows their claim is incorrect. When adjusting Lacetera et al (2012) estimates for the cluster nature of the studies, no incentive size (including the higher value of $15) is significant. In their 2013 study (Iajya et al, 2013) there was in fact a tendency for higher incentives reaching significance. Nevertheless, I argue that this propensity should not be taken as a sign that financial incentives work to promote blood donation.

Iajya et al (2013) mentioned that Argentina has an average of 12.4 donations per 1000 persons (9 per 1000 in the specific region of the study) which are below the 38 per 1000 persons in developed countries (p. 215). But these authors actually report worse outcomes in their study: a donation rate of 5 donations per 1000 under the offer of $14 voucher and 11 donations per 1000 under the offer of a $23 voucher. The donation rate changed from 0% (in the control group and $5 voucher) to 0.4% with the offer of a $14 voucher and 0.8% with the offer of a $23 voucher. Statistical significance should not override discussions about the meaningfulness of the differences found. Stutzer et al (2011) developed a nonfinancial intervention prompting students to make an active decision about blood donation and reported a 7.6% increase in the donation rate – far above the 0.8% donation rate with a $23 voucher. The effect of higher incentives may have been significant but reflect negligible increases.

The available studies did not provide information about the income level of donors and because of this limitation in research, hypothesis 3 could not be tested. It remains unclear if low income patients are more likely to be attracted by financial incentives.

Previous blood donation experience is also commonly mentioned as a possible effect modifier of the impact of incentives but my limited subgroup analysis showed no differences between first-time and previous donors.

With respect to blood quality, only two experimental studies met the inclusion criteria. One study reported no impact of a gift card on the quality of blood provided. The other study reported poorer quality donations when the incentive offered was a medical test but not when the incentive was a lottery ticket. The included observational studies suggest that offering financial incentives for blood increases the chances of transfusion-transmissible infections unless payments are contingent upon blood quality. I consider these results a partial support for Titmuss' hypothesis about the impact of

incentive in blood quality. Detrimental effects in the quality of the blood donated were Titmuss' main apprehension about offering incentives and a synthesis of the available evidence suggests this may be a valid concern – unless quality control is explicitly imposed.

The strength of this review is that it is the first to our knowledge that attempts to examine the evidence for Titmuss' influential hypotheses concerning the adverse effects of using incentives to encourage blood donation. I have revealed the paucity of experimental evidence, as well as different conclusions to earlier, unsystematic reviews. In contrast to the narrative review by Goette et al (2010), the results of my meta-analysis do not corroborate their conclusions that incentives increase blood donation. And using a more systematic methodological approach than Godin et al (2012), my review identified a larger number of studies, which allowed drawing more reliable conclusions about the non-significant effect of incentives.

3.6.1 Limitations

The main limitations of this work are related to the shortage of reliable evidence. To evaluate the quantity of blood donation, the analysis was restricted to six individual estimates (only four from higher quality studies). Some methodological limitations and their consequent risk of bias in the included studies should to be taken into account when drawing any conclusions from this review. The assessment of risk of bias suggested a moderate risk from lack of detail both in the methods of randomization, and blindness of outcome assessors to group allocation. All studies were powered to detect small effects of incentives with the exception of Ferrari et al (1985) and Mellström and Johannesson (2008) – the studies removed from the sensitivity analysis using only high quality studies. But despite these limitations, there is some degree of confidence in the result about the likelihood to donate blood: performing the analysis strictly with higher quality studies did not change the result, which suggests that the overall estimate is reliable.

For the quality of blood donated, the number of individual studies was superior but the reliability of the evidence was weaker. The heterogeneity of the observational studies mixing estimates for donor and units of blood as well as the poor definition of inclusion criteria are also limitations of this review.

3.6.2 Implications for practice and research

I found support for Titmuss's hypothesis that incentives are economically inefficient: offering incentives did not increase the quantity of the blood donated and introduced additional costs. The fact that incentives had no impact on the quantity of blood is one reason against its use in practice. Titmuss' concerns about blood quality were mostly related to first-time donors and how the offer of incentives could decrease blood quality by attracting more at-risk donors. The two experimental studies that reported on blood quality both involved previous donors, thus providing at best a partial test of this hypothesis. The observational studies provided no information on the experience of the blood donors involved.

I found no support for a motivational crowding-out effect, operationalised as a decrease in blood supply in the presence of incentives. It remains unknown, however, whether incentives had some crowding out effect on who donated rather than how many donated. For example, incentives may have alienated voluntary donors and attracted new, incentive-driven donors without affecting the overall number of donors.

Moreover, no studies were found that assessed the impact of incentives upon subsequent likelihood of donating when incentives were no longer offered – following the psychological tradition of crowding-out measurement. But the long-term effects of financial incentives in the behaviour of blood donors and negative externalities from incentivising blood donation in social behaviour should also be examined – because these were the main crowding-out effects feared by Titmuss.

Chapter 4

Incentives to Comply with Health Care: A Review

I conducted a comprehensive systematic review and the first meta-analysis of experimental studies offering financial incentives to increase health compliance. Included under the concept of health care compliance are appointment keeping, adherence to medical treatment (including medication), cancer screening, TB screening, STI screening and immunisation.

Electronic and hand searches were performed in the main databases from inception to 2013. Eighty five papers were included in the qualitative review and 20 randomized controlled trials (N=151,875) met the inclusion criteria for the meta-analysis.

Financial incentives increase health care compliance (OR=3.06 CI 95% 2.04-4.57; OR=1.42 95% CI 1.13-1.79 just considering high quality studies) but between-study heterogeneity was high. Contrary to expectation, the characteristics of the incentive schemes had no significant effect. No significant impact was found for the type of incentive, the incentive size or the timing at which the incentive was delivered. Heterogeneity was mostly explained by the different health context in which incentives are used. The only significant effect modifier other than the health context was the socioeconomic status of patients: the offer of an incentive increased the likelihood of compliance in 2.5 times in low income individuals compared to less deprived people.

4.1 Compliance with episodic health care: A gap in incentive research

Both chapter 3 (on blood donation) and chapter 4 (this chapter on compliance) comprise the secondary data analyses of my thesis, allowing for the concomitant test of several hypotheses about financial incentives in health behaviour. The previous systematic review and meta-analysis for blood donation showed that incentives did not significantly increase donation rates. Several sensitivity analyses corroborated the robustness of this conclusion but subgroup analyses for hypotheses related to incentive type and patient characteristics were based on a very small number of papers and were, therefore, less conclusive. This current review on compliance with health care includes a larger pool of studies (85 papers for the systematic review and 20 in the meta-analysis) and will enable a more rigorous test of some hypotheses about incentive features.

As previously discussed in earlier chapters, my analysis of health care compliance includes several 'discrete event' or time-limited health behaviours: cancer screening, sexually transmitted infections (STIs) screening, tuberculosis (TB) screening, immunisation, attending medical appointments and treatment adherence (medication or other). Despite the variety in health settings, performing these behaviours imply enduring an immediate present cost (e.g. waiting time, side-effects, anxiety with test results) to increase the likelihood of future benefits (e.g. better health, longer life expectancy). Abstinence from smoking and drug use, exercise or healthy eating habits are also important health guidelines but are more habitual behaviours which imply the withdrawal of immediate rewards to achieve future benefits – raising the question that incentives may have a substantial different impact in these contexts and may not be directly comparable. Moreover, research has been more prolific in the analysis of these lifestyle habitual behaviours (Charness & Rabin, 2009) which highlights the greater need to draw attention to these one-shot or short-term health behaviours. Patient noncompliance in these settings also entails significant detrimental effects to personal health and overall health expenditure (Carlsen et al, 2011; Neumman, 2012)

This work will contribute to the literature by quantifying the impact of patient financial incentives to promote compliance with health care. The only meta-analysis with a pooled estimate was performed in the area of drug abstinence with clinical patients (Lussier et al, 2006), reporting a strong positive effect. Yet this evidence is still not conclusive to inform if financial incentives are effective for the general (nonclinical) population or across a wider range of health behaviours. Despite the growing use of

financial incentives in practice to increase low compliance rates, no research has examined the effectiveness of such interventions and so far there is no information about possible effect modifiers per type of incentive and patient characteristics. I tackle this research gap providing meta-analysis and meta-regression estimates for the impact of financial incentives to promote compliance with health care in the general population.

Several previous systematic reviews have been performed (Table 4.1). However, most reviews that analysed the use of explicit financial incentives in health were general reviews about health interventions, of which incentives were one of the strategies. These global reviews were mostly analysing the effects of incentives in treatment adherence (Volmink & Garner, 1997; McDonald et al, 2002; Haynes et al, 2002; Schroeder et al, 2004; Welch & Thomas-Hawkins, 2005; Bosh-Capblanch et al, 2008) and one about cancer screening (Marcus & Crane, 1998). Two of these reviews produced quantitative estimates about the impact of different health interventions (Roter et al, 1998; Stone et al, 2002) but not specifically about incentives.

Exclusively about the impact of financial incentives, there are six reviews (Giuffrida & Torgerson, 1997; Kane et al, 2004; Lussier et al, 2006; Jochelson, 2007; Sutherland et al, 2008; Michalcuzk & Mitchell, 2009). These are narrative reviews (with the exception of Lussier et al, 2006) and only provided qualitative accounts of the effect of incentives, all suggesting a positive impact. Kane and colleagues (2004) concluded that incentives are effective to change 'simple' behaviours like attending medical appointments or immunisation but to a lesser extent more 'complex' life-style behaviours such as increasing exercise frequency, smoking cessation or drug abstinence. In this work, I am restricting the analysis to what Kane calls 'simple' behaviours and thus I hypothesise that incentives will have a significant positive impact.

These authors (Kane te al, 2004) also reported a frequency analysis in which negative incentives (e.g., sanctions) were effective in 90% of the cases, vouchers 80%, cash 73%, free medical charges 67%, lotteries 60% and gifts 57%. This suggests that penalties are more effective than rewards and, within rewards, vouchers and cash are the most effective incentives. According to them, free medical charges are effective in about two thirds of the cases – but as I will show next, these are the most frequent incentives used in the literature.

	Type of Incentive						Type of review	Type of analysis	Search strategy
	Cash-based			Goods-based					
	Cash	Lottery	Copay	Gift	Voucher	Lottery			
Giuffrida & Torgerson (1997)	√	√		√	√	√	Not Cochrane	Narrative	Systematic
Volmink & Garner (1997)	√						Not Cochrane	Narrative	Systematic
Roter et al (1998)	√	√					Not Cochrane	Meta-analysis	Not systematic
Marcus & Crane (1998)	√						Not Cochrane	Narrative	Not systematic
McDonald et al (2002)	√				√		Not Cochrane	Narrative	Not systematic
Haynes et al (2002)	√						Cochrane	Narrative	Systematic
Stone et al (2002)	√		√				Not Cochrane	Meta-analysis	Systematic
Kane et al (2004)	√	√		√	√	√	Not Cochrane	Narrative	Systematic
Schroeder et al (2004)	√						Cochrane	Narrative	Systematic
Welch & Thomas-Hawkins (2005)	√				√		Not Cochrane	Narrative	Systematic
Lussier et al (2006)	√			√	√		Not Cochrane	Meta-analysis	Systematic
Jochelson (2007)		√		√	√		Not Cochrane	Narrative	Systematic
Bosh-Capblanch et al (2008)	√						Cochrane	Narrative	Systematic
Sutherland et al (2008)	√	√		√	√		Not Cochrane	Narrative	Systematic
Michalcuzk & Mitchell (2009)	√						Cochrane	Narrative	Systematic

Table 4.1 Summary of systematic reviews and meta-analyses including the analysis of patient financial incentives

The few randomised controlled trials that tested the impact of different incentives have only focused the comparison of cash versus vouchers of an equal value (Deren et al, 1994; Kamb et al, 1998; Malotte et al, 1999; 2004; Tulsky et al, 2004; Vandrey et al, 2007). In all these cases, cash was more effective than vouchers in promoting compliance. Mallote and colleagues (1999) compared $10 cash, $10 fast food voucher and $10 grocery voucher and showed that cash was significantly more effective than either voucher type. All these field studies suggest a discrepancy with the review from Kane et al (2004). Promberger and colleagues (2012) showed that grocery vouchers were more acceptable than cash or vouchers for luxury items (about a 20% difference) but behavioural data from past field studies (Deren et al, 1994; Kamb et al, 1998; Malotte et al, 1999; 2004; Tulsky et al, 2004; Vandrey et al, 2007) does not seem to support these self-reported preferences.

Lussier and colleagues (2006) produced the only piece of evidence quantifying the effect size of patient financial incentives. The estimated average effect size from 30 studies was 0.32 (95% CI 0.26–0.38). By target behaviour, their results showed that incentives targeting attendance produced average effect sizes of 0.15 (95% CI 0.02–0.28), while those that targeting medication compliance produced an average effect of 0.32 (95% CI 0.15–0.47). However, this meta-analysis was restricted to substance abuse patients and it is not unequivocal if incentives would have the same effect in the different one-shot health behaviours I am analysing.

Moreover, these authors (Lussier et al, 2006) also showed that more immediate voucher delivery and greater monetary value of the voucher were associated with larger behavioural changes. Again, it is not clear if these results hold in the particular health behaviours examined in this work. About the delivery schedule (immediate versus delayed) of the incentive, there is no additional evidence apart from Lussier et al (2006). With respect to the value of incentive, there is a single study testing the impact of different incentive sizes for STI screening. Mallote et al (1998) compared the offer of $5 cash versus $10 cash but showed no significant difference between the incentives.

Notwithstanding the included health settings sharing the common underlying feature of immediate costs, different barriers to compliance have been reported for each context (Table 4.2). This diversity in barriers can help to understand potentially different impacts of incentives per health care contexts – regardless of my prediction of an overall significant positive impact (H1 below).

Context	Main Barriers to Compliance
Appointment keeping	Memory lapses; competing activities (*Stubbs et al. 2012; Parikh et al. 2010*)
Medication/ Treatment adherence	Complexity of medication schedule; Pain and side-effects; Memory lapses *(Campbell et al. 2012)*
Cancer screening	Lack of screening recommendation or health insurance; Anxiety and fear of screening results *(Weller et al. 2009; Guessous et al. 2010);*
TB screening	Low of perceived risk; high social deprivation and low socioeconomic status of more at-risk individuals *Tulsky et al (2000; 2004)*
STI screening	Stigma and embarrassment; fear of sexual partners' reaction *(Bokhour et al. 2009; Waller et al. 2009)*
Immunisation	Misconceptions or lack of information and knowledge *(Brown et al. 2010; Mortensen, 2010; Hollmeyer et al. 2009)*

Table 4.2 Main barriers to compliance per health care context

Taking the example of a £5 voucher, it is expected that this incentive will increase the likelihood to comply with health care when the anticipated utility of receiving the incentive is higher than the utility of non-adherence (e.g., staying home) or the costs of performing it (reported barriers). But the utility provided by this £5 voucher may be higher than the effort to keep track of appointment dates but not greater than the perceived cost of painful screening tests or medication side-effects. I will provide estimates of the effect size of incentives for each health context in analysis.

4.2 Hypotheses

I propose several hypotheses to examine the effectiveness of patient financial incentives. Eight main hypotheses will be examined. This set of hypotheses covers the main effect of financial incentives (H1) and predicted key effect modifiers (Conrad & Perry, 2009) as incentive size (H2), type of incentive (H3-H5), delivery schedule (H6), patient socioeconomic status (H7) and previous compliant behaviour (H8). These hypotheses are motivated and informed by the literature review discussed in Chapter 2.

The first hypothesis is related to the main effect of patient incentives in health care compliance. According to the theoretical perspectives reviewed in Chapter 2, both from standard economics (Laffont & Mortimer, 2009) and operant conditioning (Standdon & Cerutti, 2003), patient financial incentives are predicted to increase health care compliance. Hypothesis 1 does not express an expectation of motivational crowding-out – to be measured by a decrease in behaviour rates once incentives are offered - given the instrumental (and not pleasurable) nature of complying with health guidelines. Some variability is expected in the effect size of incentives between health care contexts (given the significant variety in underlying barriers) but I predict the overall effect across health contexts to be positive.

H1: Financial incentives will increase health care compliance.

Assuming that people interpret health settings as money markets and not social markets (Heyman & Ariely, 2004) patients should be sensitive to incentive size. Hypothesis 2 is also on track with standard economic and operant conditioning, assuming that that the larger the incentive, the higher the likelihood to comply with health care.

H2: There is a positive monotonic association between health care compliance and incentive size.

Cash-based incentives (money) are assumed to be preferred to goods-based incentives (vouchers, gifts) due to a higher fungibility of money, which can be exchanged by any good and thus maximising utility (Thaler, 1990). This hypothesis is concordant with H1 in the sense that no motivational crowding-out effects are expected. Crowding-out is mostly associated to the offer of monetary incentives and less to vouchers or gifts (Promberger & Marteau, 2013). Again, as I do not predict incentives to crowd-out health care compliance, I follow standard economics predictions in this point. Also, this

prediction is in line with the limited previous research. The few randomised controlled trials that tested the impact of different incentives have only focused in the comparison of cash versus vouchers of an equal value (Deren et al, 1994; Malotte et al, 1999; 2004; Kamb et al, 1998; Tulsky et al, 2004; Vandrey et al, 2007). In all these cases, cash was more effective than vouchers in promoting health behaviour.

H3: Cash-based financial incentives will increase health care compliance more than goods-based incentives.

In a context as health compliance which requires an immediate cost, certain incentives as cash or vouchers are likely to be more effective than prize draws because they provide a guaranteed benefit (Keren & Roelofsma, 1995). Certain incentives provide a sure compensation compared to prize draws (Weber & Chapman, 2005).

H4: Certain incentives will be more effective than prize draw incentives to increase health care compliance.

According to time preferences research (Keren & Roelofsma, 1995; Prelec & Loewenstein, 1991) and operant conditioning (Martin & Pear, 2007), financial incentives offered concurrent or immediately after compliant behaviour are more likely to promote behaviour change, compared to incentives offered after some time delay (e.g., incentives is mailed to participants only at the end of the study). The only similar evidence in health settings supporting this hypothesis is from Lussier et al (206) but in a context of drug abuse.

H5: Incentives delivered immediately after behaviour are more effective to promote health care compliance than incentives offered after a time gap.

Based on loss aversion from Prospect theory (Kahneman & Tversky, 1979) I expect that negative incentives (e.g., withdrawal of welfare benefits) will be more effective to increase health compliance than positive incentives (rewards).

H6: Negative incentives will increase health care compliance more than positive incentives.

Within the general (nonclinical) population, the offer of incentives is predicted to be particularly effective if offered to low income or socially deprived individuals. Diminishing marginal utility of income suggests that poorer individuals would be more

motivated by financial incentives – which would contribute proportionally more to their overall wealth (Layard et al, 2008).

H7: Financial incentives will increase health care compliance more for low (compared to higher) income individuals.

Another patient characteristic I predict to be important is past compliance behaviour. Particularly in the psychological literature about motivational crowding-out, there is the hypothesis that incentives are only detrimental to people with high baseline motivation. People with low baseline levels of intrinsic motivation are expected to respond positively to the offer of an incentive (Deci et al, 2001; Deci & Ryan, 1985). I take the compliance with health care in the past as a proxy for patient motivation (Promberger & Marteau, 2013). Thus, I predict that incentives will be effective to increase health care compliance in previous non-compliers.

H8: Financial incentives will increase health care compliance for previous non-compliers but not previous compliers.

4.3 Method

This review and meta-analysis followed a similar methodology as described in the previous chapter.

4.3.1 Literature search and data sources

Electronic searches were performed in MEDLINE, EMBASE, ECONLIT, JSTOR, TROPHI (Trials Register of Promoting Health Interventions), Clinicaltrials.gov, Cochrane Central Register of Controlled Trials, PsycInfo, CINAHL, ERIC, Business Source Complete, Dissertation databases (ETHOS, DART-Europe, PROQUEST Dissertations and Theses), RAND Corporate, Association for Policy Analysis and Management; SSCI; Public Affairs Information Service (PAIS); Open-SIGLE database; NIH crisp.cit.nih.gov; Current Controlled Trials. Google and Yahoo searches and hand-searches on the main Health journals were also performed, in addition to the reference search from relevant papers. Experts' mailing lists (Health-incentives@Jiscmail.ac.uk; BPP@Jiscmail.ac.uk) were contacted as well as individual author contacts in the UK and US. Searches were performed from inception to 2012 (for complete search strategy see Appendix 2). The search strategy was repeated in 2013 to identify more recent papers.

4.3.2 Study selection

Cochrane Review handbook was used to guide the methods used in this review (Higgins & Green, 2011). This review was not registered with Cochrane Collaboration but followed the guidelines established by this organisation. Inclusion criteria were a) interventions to promote health care compliance including: cancer screening, STI and TB screening, immunization, medication adherence and medical appointment keeping; b) baseline reference or control group (for meta-analysis requirement of experimental design); c) at least one of the interventions is the offer of a financial incentive; d) studies in developed countries. Studies were excluded in case of a) the size of incentive was not stated (for meta-analysis only) b) no control group or pre-post treatment comparison; c) multi-component interventions in which incentives are included; d) free syringe exchange programs; e) developing countries; f) incentives targeting providers of health care; g) study not written in English language.

4.3.3 Data extraction

Two review authors pre-screened all search results (titles and abstracts) against the selection criteria for possible inclusion, and those selected by both review authors were subjected to a full-text assessment. Two review authors independently assessed the selected full-text articles for inclusion, resolving any discrepancies by consensus. Variables of interest included study participants, study design, incentive, outcome measure and results.

4.3.4 Data analysis and synthesis

In the meta-analysis, odds ratio (OR) was used as the estimate of effect from individual studies because it is the most appropriate metric to combine trials with binary outcomes (Egger et al, 2001). I used a random-effects model given the variety in contexts of medical compliance and types of incentives offered. The random-effects method assumes statistical heterogeneity with individual studies varying around an average treatment effect with a normal distribution. This estimate, however, gives more weight to smaller studies which may produce an overestimation of the overall effect size of incentives because smaller studies tend to have more beneficial estimates. This will be controlled for with Egger's test and meta-regression. Study heterogeneity will be examined with sensitivity and subgroup analyses and random-effects meta-regression. Data analysis was performed in STATA 11 according to Sterne (2009).

4.3.5 Assessment of Risk of Bias

Risk of bias was assessed for the papers included in the meta-analysis in accordance with the guidelines of the Cochrane Consumers and Communication Review Group (Higgins & Green, 2011) which recommends the explicit reporting of individual elements that affect risk of bias, including:

1. Sequence generation: classified as adequate if carried out using true randomization and not quasi-randomization, such as by day of week, date of birth or sequence;
2. Allocation concealment: classified as adequate if allocation is concealed from the purveyor of risk information, researchers and the participant at least until the point of allocation to groups;
3. Blinding: classified as adequate if participants, staff and outcome assessors are blind to allocation;

4. Incomplete outcome data: classified as adequate if attrition data are clearly reported and there is no evidence of differential drop out in the intervention and control groups;
5. Selective outcome reporting: classified as adequate if data are provided for all outcomes specified in the study protocol, or where this may be unavailable, in the methods section;
6. Other sources of bias, including baseline comparability: classified as adequate if groups are comparable at baseline or any differences at baseline are adjusted for in the primary analysis; and validation of measures, classified as adequate if there is evidence of reliability and validity reported in the study or published elsewhere.

4.4 Results

After the initial literature search, 1,172 records were screened after duplicates were removed (Figure 4.1). One hundred and fifty two full-text papers were assessed for eligibility, of which 85 papers were included in the qualitative review and only 20 in the quantitative review. Tables 4.3-4.8 detail the studies included in our analysis.

4.4.1 Systematic Review

Papers reporting interventions using incentives have been sharply increasing over time with three papers between 1970-1979, 12 between 1980-1989, 26 between 1990-1999 and 44 between 2000-2012 (N=85). Most studies were developed in the United States (95%). Randomised controlled trials represent 61% of studies (5% cluster randomised trials), 29% are quasi-experimental studies and 10% are observational cross-sectional or case-control studies. Most studies (Figure 4.2) offered incentives to promote treatment adherence (31%), followed by appointment keeping (25%) and cancer screening (19%). Less frequent were studies targeting immunization rates (13%), STI screening (8%) and TB screening (5%).

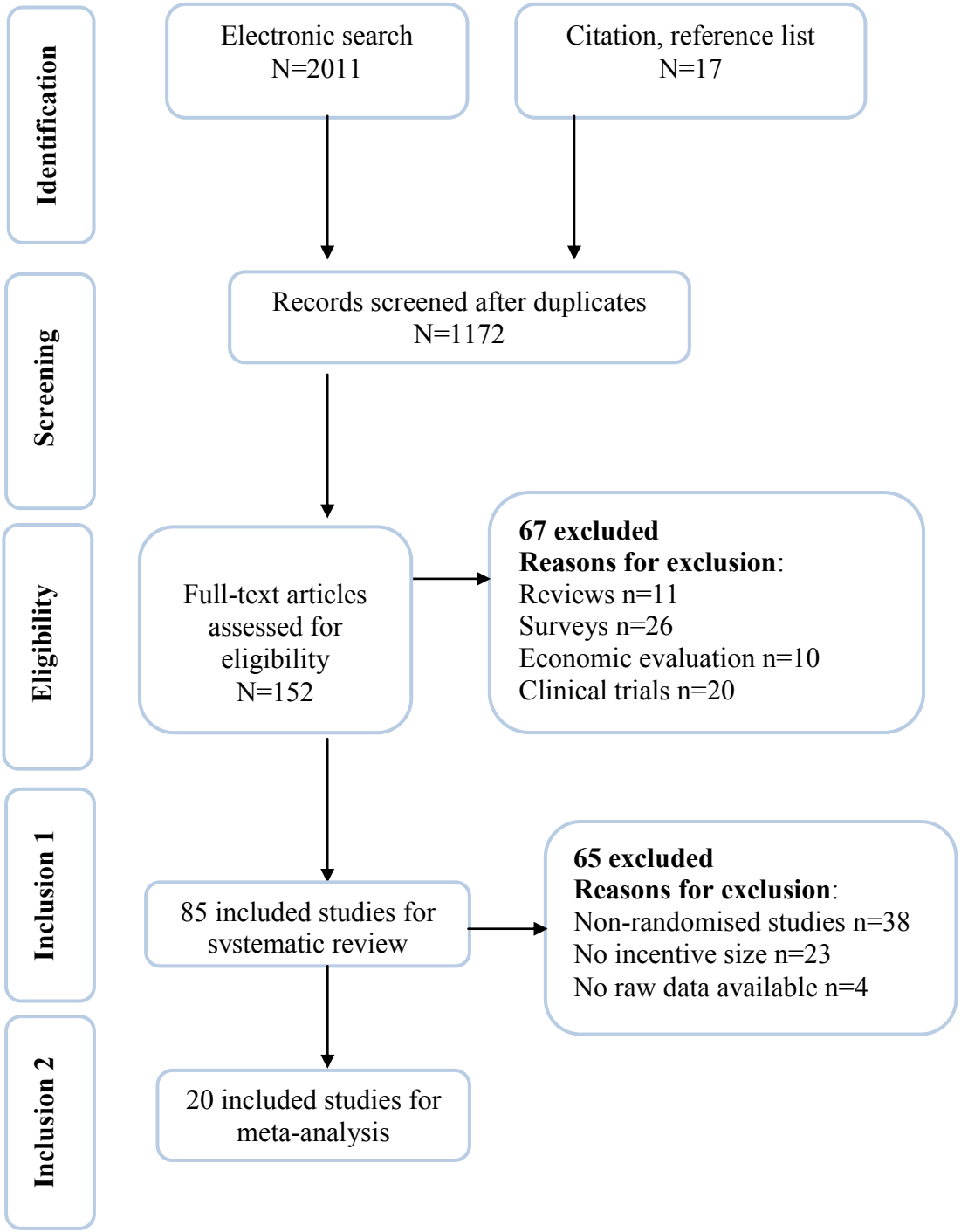

Figure 4.1 PRISMA flow chart for health care compliance review

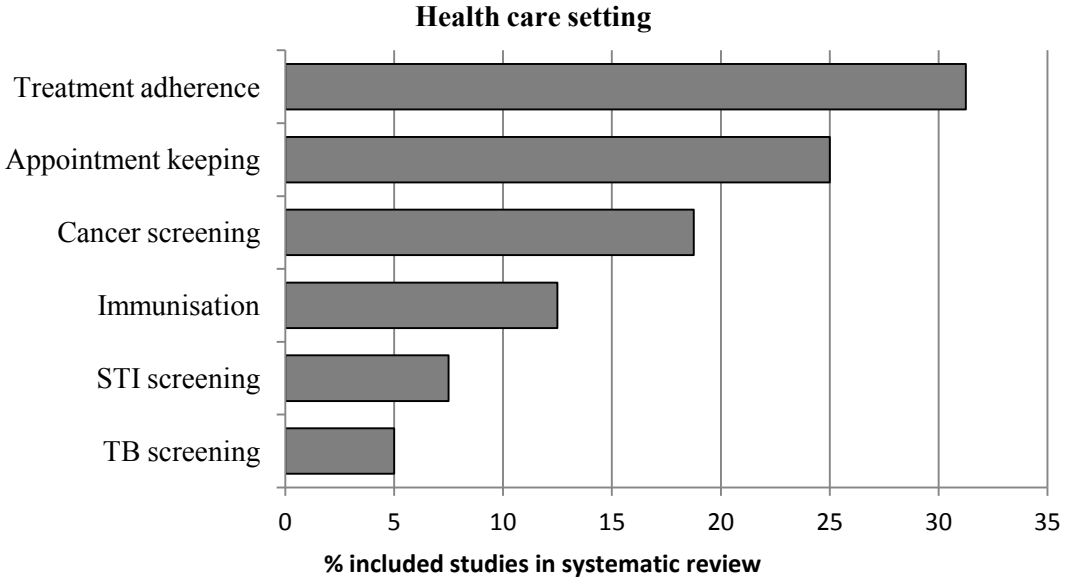

Figure 4.2 Studies per health care compliance settings

The most frequent incentives offered (Figure 4.3) were cost deductions (introducing free coverage and decreased copayments). As initially mentioned, the most traditional approach to changing behaviour using incentives in health settings has been this indirect application also via supply-side prices. The offer of tangible incentives is less common and has become more frequent in recent years. Nevertheless, explicit offers of cash already represent over 25% of the patient incentives used, above vouchers (17%) and lotteries (12%). Penalties and gifts were seldom used.

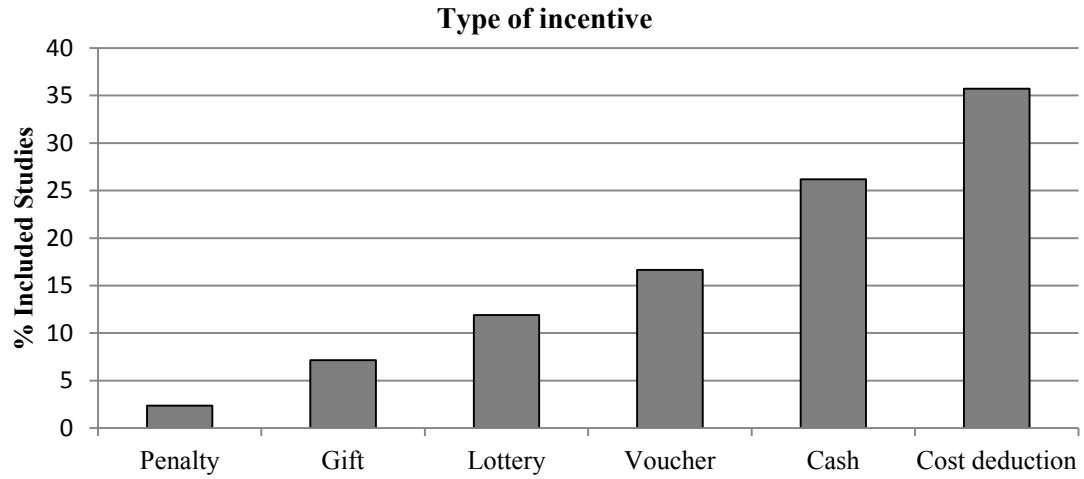

Figure 4.3 Types of incentives used in intervention studies

The analysis of incentive size is presented in Figure 4.4. The size of the incentives offered was adjusted to 2012 prices ($US). There is a balanced distribution in the amounts offered to patients. Overall, the incentives used were small, with roughly 50% up to $10 (£7) and 90% of the incentives under $30 (£20). Cost deductions were not only the more frequent type of incentives used but also the incentives with the highest size, particularly in the context of free screening tests (free mammography) and immunisation (free vaccination).

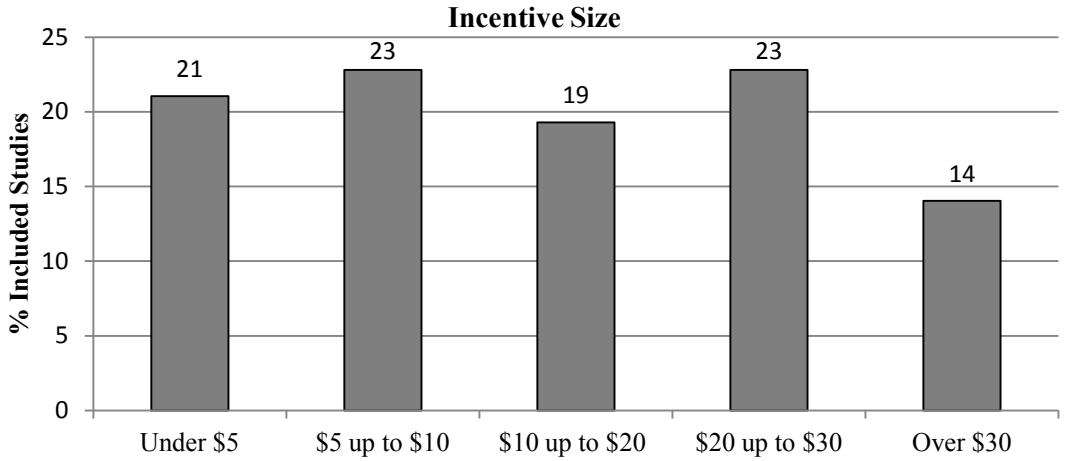

Figure 4.4 Different incentive sizes offered

The main reasons for the considerable reduction from the number of included papers in the qualitative review (N=85) to the meta-analysis (N=20) were the lack of an experimental design and the unspecified amount of the incentive (Figure 3.1). Most of the excluded interventions were reported changes in health insurance cost-sharing plans (e.g., Trivedi et al, 2008), particularly for medication adherence. The amount of the incentive is a potentially important effect modifier and thus justifies it as an exclusion criterion. These exclusion criteria, nevertheless, prevented us including into the analysis the prominent RAND Health Insurance Experiment (HIE). The RAND HIE was a randomised controlled trial which assigned thousands of people to different kinds of insurance cost-sharing plans and followed their health behaviour from 1974 to 1982. The overall conclusion is that cost-sharing reduced the uptake of health care, compared to free plans (Manning et al, 1987; Foxman et al, 1987; Leibowitz et al, 1986; Lurie et al, 1989; Brook et al, 1985). The RAND HIE is an example of an intervention testing copayments versus free plans and this was the approach used by several other papers

(e.g., Meeker et al, 2011; Chernew et al, 2008; Maciejewski et al, 2009; Atella et al, 2006). At a glance, this stream of research concludes that increased copayments reduce the uptake of health care whereas decreased copayments promote compliance with medical recommendations. A recent narrative review on this topic corroborates this conclusion (Eaddy et al, 2012). When the baseline status is cost-sharing and the intervention is patient exemption, this is a positive incentive with negative reinforcement (elimination of cost). But when the baseline status is a free plan and a copayment is introduced, this is the case of a negative incentive or punishment (introduction of cost). Despite of the interest originated by Prospect theory with loss aversion and the hypothesis that penalties are more effective than rewards, it is not possible to test this difference using cost-sharing studies. Research in this area is strictly based on quasi-experimental pre-post design studies and there are no experimental studies comparing increased fees with exempting patients from payment. Therefore, this evidence will not be included in the meta-analysis. Furthermore, strictly speaking, cost deduction are not tangible incentives and thus not rigorously within the boundaries of the topic of this thesis.

There is an additional relevant point raised by these cost-sharing studies. Some studies examine the impact on behaviour of free health care at the point of use whereas other report reimbursement of expenses at a later stages. In both cases, positive incentives are introduced but time discounting predicts that immediate free coverage will be more effective to increase health behaviour than insurance plans with reimbursement practices (Cooper & Vistnes, 2003). A reimbursement implies that patients have to bear the cost of health care in the first instance and be compensated at a later stage. Research from a behavioural economics perspective about the uptake and use of health insurance has been lately expanding (Baicker et al, 2012) and calling attention to these apparently minor, but potentially decisive, differences.

The hypotheses formulated above are intended to be tested in the meta-analysis, particularly with meta-regression. However, hypotheses 6 and 8 will be excluded due to lack of evidence. Regarding **hypothesis 6**, there are only two other studies using penalties to change health behaviour, both related to child immunisation. The penalties applied were the withdrawal of welfare benefits (negative punishment). Minkovitz and co-workers (1999) examined the impact of a monthly penalty but reported no effect: the incentive group had 62% of immunised children after two years compared to 63.5% in control group. However, control over the immunisation rates was

performed only every six months which may have decreased the impact of the penalty. Kerpelman and colleagues (2000) found that immunisation was higher in the intervention group (72.4%) compared to the control group (60.6%) ($\chi 2=13.4$, $p<.001$). The authors did not report the value of the penalty. Both studies are excluded from the meta-analysis because no information was given about the size of the incentive.

With respect to **hypothesis 8**, there is a single study that reported the difference in the effectiveness of incentives between patients who were previously compliers or non-compliers (Stoner et al, 1998). This study is also only included in the qualitative review because the authors do not provide the raw data and information about the incentive size. The results from this study show that the offer of a voucher for free mammography was only effective to promote screening in previously non-compliant women (OR 4.80 CI 1.83-12.58) but not in previously compliers (OR=1.77 CI 0.70-4.48 n.s.).

The next tables detail the characteristics of the studies included in the qualitative review. The studies related to TB screening are presented in Table 4.3 (p.96), studies on immunisation are displayed in Table 4.4 (p.97), studies on cancer screening in Table 4.5 (p.99), studies on treatment adherence in Table 4.6 (p.102), studies on appointment keeping in Table 4.7 (p.109) and studies on STI screening are presented in Table 4.8 (p.114).

Grey shaded papers in Tables 4.3-4.8 were the included studies in the meta-analysis that will be presented in the next section. Only experimental studies will be included in the meta-analysis.

Authors	Target	Study design	Participants	Incentive scheme	Findings
Chaisson et al (1996)	Tuberculin skin test (PPD)	Quasi-experiment seq. design	501 participants; mean age=36; 69% males; 75% Black	Voucher fast food restaurant $4	Food voucher incentive increased compliance from 35% control group to 48% voucher (p=.004)
Malotte et al (1999)	Return appointment for TB skin reading	RCT	1078 participants; age range 18-30; 78% males; 82.5% unemployed	$10 cash or $10 grocery coupon or $10 fast food coupon	Control group return 49.3% compared to 94.9% cash, 85.7% grocery coupon and 82.6% fast food coupon (significant difference between cash and other incentives)
Malotte et al (1998)	Return appointment for TB skin reading	RCT	1004 patients; age range 18-30; 68% males; 53.5% African American	$5 or $10 cash	93% of those receiving $10 incentive and 85.8% of those receiving $5 returned compared to 33% control group
Perlman et al (2003)	Screening chest X-rays for TB	Quasi-experiment seq. design	177 patients; mean age=40.5; males 65%; employed 22%	$25 cash	Adherence 83% incentive group versus 34% prior to incentive (p<.001 OR=9.1 CI 3.9-22)

Table 4.3 Included studies about tuberculosis (TB) screening

Authors	Target	Study design	Participants	Incentive scheme	Findings
Birkhead et al (1995)	Child immunisation	Cluster RCT	6181 children median age=14 Low SES 83% Medicaid	Food voucher monthly instead of bi-monthly; unclear amount	Children at incentive sites were almost three time likely to have been immunised than control
Ives et al (1994)	Flu vaccination	RCT	1989 patients; Age range 65-79 years	Free immunisation: unclear previous cost	66% of incentive group compared to 54% of controls received immunisation ($\chi 2=138$ p=.0001)
Kerpelman et al (2000)	Child immunisation	RCT	2500 children; Mean age=3; 51% males; 85% Black	Sanction on families; unclear amount	Complete immunisation higher in intervention group (72.4%) than control (60.6%) ($\chi 2=13.4$, $p<.001$)
Mayoryk & Levi (2006)	Flu vaccination	Quasi-experiment pre/ post design	627 hospital employees	Cash bonus plus double amount if 80% uptake (unclear $)	Employee flu vaccination 32% during 2004-2005 (pre-incentive) and 84.2% during 2005-2006 (incentive)
Minkovitz et al (1999)	Child immunisation	RCT	2246 children; age range 3-24 months; 51% males 69% Black	Monthly penalty during 2 years but controlled with a six month delay	No effect – Incentive group overall 62% immunised children compared to 63.5% in control group
Moran et al (1996)	Flu vaccination	RCT	797 participants; mean age=65; 66% females;	Lottery for one of three coupons of $50	The lottery incentive led to a significant modest increase in influenza immunisation

			w/ health risk factors	(draw max 3 months after)	(20% vs. 29%) (OR 1.68 CI 1.05-2.68 p=.03)
Nexoe et al (1997)	Flu vaccination	RCT	585 participants over 65 years old; 40% males	Free vaccination (usual cost $40-$60)	The flu vaccination rate was 49% for usual pay and 72% for free vaccination
Satterhwaite (1997)	Flu vaccination	RCT	2791 patients over 65 years old	Free flu vaccine (usual cost $20)	Free flu vaccine 2.65 more likely to be taken ($\chi 2=173$, $p<.001$).
Stitzer et al (2010)	Hepatitis B vaccination	RCT	26 participants mean age 45; 81% males; 73% Black	Cash payments began at $20/visit and increased by $5 each month to a max $50 - Total $265	No effect - total injections received not different per group: 91% in incentive group vs. 78% in control group p=.219
Yokley & Glenwick (1984)	Child immunisation	RCT	715 children; mean age 37.3 months; males 50%; 64% White	Three lotteries of $100, $50 and $25; Lotteries drawn after 2 months study start	Monetary intervention group had higher frequency of children being inoculated (27%) than controls (12%) $\chi 2=36.53$ $p<.001$.

Table 4.4 Included studies about immunisation

Authors	Target	Study design	Participants	Incentive scheme	Findings
Breen et al (1997)	Breast Cancer screening	Observational cross-sectional	Control n=1565 Incentive n=1373; white women; 65-74 years old	Reimbursement of mammography cost with co-pay of 20%; previous average cost $91-20%≈$73)	5 sites with control (C) and incentive (I) groups; Three sites were responsive to incentives (61% vs. 69 % p=.031; 44% vs. 60% p<.001; 53% vs. 60% p=.032). In two sites ns. (65% vs. 65%; 52% vs. 57%)
Freedman & Mitchell (1994)	Colorectal Cancer Screening	RCT	146 patients; mean age=58.4; 68% females; 66% Black	Prepaid postage to send test	Control group return rate lower (57%) than incentive group (71%)
Grady et al (1988)	Breast self-examination	RCT	153 participants mean age=45; 88% White	Instant lottery costing $1 after each menstrual cycle for 6 months	Women in the external reward reported a higher rate of examination (73%) than those in no-reward group (54%)
Kiefe et al (1994)	Breast Cancer Screening	RCT	119 women; mean age 70.9; 77% Black; <10,000 income	$50 free mammography	44% in the voucher group and 10% in the control group obtained a mammography
Kelaher & Stellman	Breast Cancer Screening	Observational cross-sectional	2419 women eligible for Medicare; 1872 not eligible	Reimbursement of mammography cost (still with a co-	Eligible Medicare women increased screening from 47.7% in 1990 to 63.3% in 1993. Non eligible women 53.3% in 1990 to

(2000)				payment of $11.63)	60.8% in 1993 (OR 1.2 CI 0.9-1.4)
Klassen et al (2002)	Breast Cancer screening	Observational case-control	576 women; age range 45-55 <$10,000 44%	Free mammography unclear initial cost	84% of cases compared to 61% of controls reported having been screened in the previous year (p=.0000)
Marcus et al (1992)	Screening follow-up to abnormal Pap Smears	RCT	2044 women; age range >50% 20-29; no insurance 69%	Transport incentives around $2-$2.90	Women in the incentive condition were almost one and a half times more likely to return for screening follow-up (OR 1.48 1.06-2.06)
Marcus et al (1998)	Screening follow-up to abnormal Pap Smears	RCT	1453 women; 57% <30 years; Hispanic 84%; not insured 71%	Reduction 2/3 fixed cost of follow-up: $20 first year $25 second year	63.9% women in control group and 71.2% women in incentive groups returned to follow-up (p<.05) Incentive OR 1.5 CI 1.09-2.05
Mayer & Kellogg (1989)	Breast Cancer Screening	RCT	96 women (control n=47); age>35; 89% white; Mid SES	$50 free mammography	Appointment making was significantly higher among the incentive group (81%) than the control group (59%) $\chi 2=4.86$ p<.05
Meeker et al (2011)	Colorectal, breast and cervical cancer screening	Quasi-experiment pre/ post design	441066 participants; mean age 54.6; 42.5% males	Free coverage; introduction of first-dollar coverage for preventive care	Differences in plans with policy change: Lipid screen +0.053; Mammography +0.023; Pap smears +0.078; FOBT +0.041

Miller & Wong (1993)	Colorectal Cancer Screening	RCT	325 patients; age 50-65; 72.5% females	Prepaid stamped FOBT	Pre-stamped tested were returned more (74%) than unstamped tests (61%)
Skaer et al (1996)	Breast Cancer Screening	RCT	80 women; mean age 52.4; 95% <$15,000	Free mammography – unclear cost	In the control group, 17.5% received a mammography compared to 87.5% in the voucher group (p<.0001)
Slater et al (2005)	Breast Cancer screening	RCT	145,467 women; mean age 49.7 (40-64)	$10 cash	Significant effect of incentive: Mail (control) vs. Mail +Incentive 0.52 (CI 0.32-0.72).
Schillinger et al (2000)	Cervical and breast cancer screening;	Quasi-experiment pre/ post design	383 participants >52 years old; below Federal Poverty Level	Full coverage- Unclear previous cost	Breast cancer screening from 21% to 52% ; Pap smear from 25% to 55%; Routine check-up from 41% to 61%; Cholesterol check from 28% to 61%
Stoner et al (1998)	Breast Cancer Screening	RCT	187 women; mean age 59.4; <$20,000 32.5%	Free mammography – unclear cost	Voucher effect on baseline noncompliers (OR 4.80 CI 1.83-12.58) and previously compliers (OR=1.77 CI 0.70-4.48 n.s.)

Table 4.5 Included studies about cancer screening

Authors	Target	Study design	Participants	Incentive scheme	Findings
Atella et al (2006)	Adherence to medication Hypertension	Observational cohort study	6-year period 1997-2002; 38,393 patients	No co-payment on drug prescriptions (previous €1.5 per prescription)	Estimated mean adherence before 0.6395 and after no-copayment 0.7355
Bock et al (2001)	TB treatment	Observational Case-Control	107 patients; Median age=37; African American 87.5%	$5 coupon per TB treatment	Incentivised patients more likely to complete treatment in 32 weeks (60%) or 52 weeks (89%) compared to historic controls (19% and 52%)
Barnett et al (2009)	HIV medication	RCT	66 patients; mean age=43; 59% males; employed 4.5%	Escalating amount per session total max $1172 in vouchers for groceries/ goods	Cap openings DV- 77.6% incentive and 55.5% control (p<.001). During 4 week follow-up, 66% incentive and 53% control (p=.07)
Capelli (1990)	Fluid adherence in hemodialysis (below weight criterion)	Quasi-experiment pre/ post design	49 patients; mean age≈52; ≈67% females; 78.5% Black	Lottery; each of the 34 patients contribute $1 per compliant session to group draw	Sessions within weight criteria: Baseline 66.7% and Incentive 100% (return to baseline 87.5%)
Chernew et al	Adherence to medication	Quasi-experiment	Control n=144604; Incentive n=73674;	Generics $5 to zero; brand-name drugs $25	DV Medication Possession Ratio (MPR); Increased adherence from 1.86 percentage

(2008)	(hypertension diabetes and steroids)	pre/ post design	mean age range 37.4-44.7; 52% females	to $12.5 (Preferred drugs) and $45 to $22.5 (non preferred drugs)	points (p=.134) for steroids to 4 percentage points for diabetes medication (p<.001): 7-14% reduction in non-adherence
Davidson et al (2000)	TB treatment	Quasi-experiment pre/ post design	384 patients; mean age=40; 75% males; 83.8% unemployed	Basic incentive of $15 increased to $30 after first 2 months & $20 end 3rd month (kind)	Additional incentives significantly related to adherence: AOR 1.01 (CI 1.00-1.02)
Doshi et al (2009)	Lipid-lowering medication adherence	Quasi-experimental	5604 patients; aged 60-85; 98% males; low SES	Copayment increase from $2 to $7	Co-payments decreased medication adherence between 12%-19% (p=.0001)
Foxman et al (1987)	Use of antibiotics	RCT RAND Health Experiment	Free plan n=1935; Cost-sharing n=3830; US national sample	Free plan vs. cost sharing (coinsurance rate could be 25%, 50% or 95%)	All incomes: higher use on antibiotics in free plan OR=1.80 (CI 1.75-1.86)
Hagihara et al (2001)	Adherence to hypertension medication	Observational cohort study	1236 patients; mean age 59.43; 40% males	Change from a 90% coverage to full coverage at 70 years old	Compared to 90% coverage (OR=1) a full coverage had OR=2.62 (CI 1.24-5.43 p=.01) for 70-75 and 1.55 (CI 0.58-3.94 p=.86) for 76+

Hart et al (1979)	Fluid adherence in hemodialysis (below weight criterion)	Quasi-experiment pre/ post design	10 male patients	Within 2% of dry weight=5 tokens; within 5%=2 tokens; unclear amount; in-kind	Significantly lower weight change F(6, 54)=6.00 p<.01); Mean weight (pounds) baseline ≈167 and experimental period 162
Hynd et al (2008)	Medication adherence	Observational study	Unclear sample	24% increase in various medications	Significant decrease in medication dispensing (3.2%-10.9%)
Iwata & Becksfort (1981)	Adherence to oral hygiene programme	RCT	21 patients; all patients over 18 years old	Fee reduction (refund after 5 visits) if plaque index 10% or better; Reduction 25% fee; Usual cost $120 ($30 incentive)	In incentive condition, 88% met the final criterion of 10% plaque index compared to 7% in control group (F=1,58)=237.82 p<.001.
Kominski et al (2007)	TB treatment	RCT	398 patients; mean age 15.4; 48.6% females; 78% students	Gifts paid by parents e.g., money or going out; unclear amount and schedule	In usual care (control) 148 adolescents (75.8%) completed treatment compared to 150 in the incentive group (73.9%)
Leibowitz et al	Prescription drug use	RCT RAND Health	Free plan n=1259; Cost-sharing plan	Free plan vs. cost sharing (coinsurance	Prescription number per capita: Free Plan M=5.43 significantly higher than any cost-

(1985)		Experiment	n=2601	rate could be 25%, 50% or 95%)	sharing Plans M=4.2
Lund et al (1977)	Complete dental treatment	RCT	98 students 7th grade	$0.25 to $1 per each of 3 treatments; Bonus prize of $3 if treatment completed	Less controls completed treatment (61.5%) than incentive group (76%)
Lurie et al (1989)	Attendance to eye examination	RCT RAND Health Experiment	Total enrolled 3,958; two thirds participants 18-44 years old	Free plan vs. cost sharing (coinsurance rate could be 25%, 50% or 95%)	90% had eye examination in free plan compared to 76% in cost sharing plans
Maciejewski et al (2010)	Adherence to medication (multiple health conditions)	Quasi-experiment pre/ post design	Participants 638,796 enrolees from employers plus 108,504 self-insured	Free generics (before $10.74-$11.38) and reduced brand-name from $33.70-$34.39 to $30.50-$30.74	DV Medication possession ratio (using claims data); For generics, average percent change of +2.61 p<.0001; for brand-name average -0.57 ns
Malotte et al (2001)	Completion of TB treatment	RCT	169 patients; mean age=42; 82% males; 71% Black	$5 each visit	3.6% patients in the control completed care compared to 52.8% in the incentive (AOR=29.7)
Manning et al	Demand for medical care	RCT RAND Health	Free plan n=1893; Cost sharing n=3916	Free plan vs. cost sharing (coinsurance	Likelihood of any use Free plan 86.7% (SE=0.67); Cost sharing 73.4% (SE=1.37);

(1987)		Experiment		rate could be 25%, 50% or 95%)	
Morisky et al (2001)	Completion of TB treatment	RCT	794 adolescents; Mean age 15.2; 49% male; 77.8% Hispanic; 90%<= High School	Gifts paid by parents e.g., money or going out; unclear amount; one incentive early treatment and one for completion	No effect - Completion of care (6-month medication adherence) did not vary significantly across study groups: 77.8% in control group and 76.4% in incentive
Motheral & Henderson (2009)	Medication adherence	Quasi-experimental pre-post design	Unclear sample	$10 to $15 increase in co-payment	No effect – increased copayment was not associated with changes in adherence
Nair et al (2009)	Adherence to diabetes medication	Quasi-experiment pre/ post design	225 patients in all observation periods; Mean age 49 years old; 53.4% women	Change of a 3 tier plan with $10, $20 and $40 co-pays to a generic $10 co-pay (Reduction $10-$30)	Pre-period 67.34% mean adherence compared to 75.08% 1st year (diff 7.74 p<.001) and 72.77% 2nd year (diff from 1st -2.31 p=.088)
Sedjo & Cox (2008)	Adherence to medication (Statins)	Quasi-experiment pre/ post	13,319 patients; Mean age 63.33 SD=12.02; 45% female	Mean pre-period copayment $14.6 SD=$9.11; Co-payment	Adjusted mean adherence increase of 3.51% for co-payment decline $15+; 1.81% for co-payment decline of $10.01-

		design		reduction from $0 to $15+	$15; -0.21% for co-payment decline of $5.01-$10; -1.71% for co-payment decline $0.01-$5; -3.22% for $0 co-payment decline
Sonnier (2000)	Fluid adherence on haemodialysis	Quasi-experiment pre/ post design	Total 6 patients; 4 men and 2 women; mean age 43; two thirds Caucasian	$3 for 3%-4% weight criteria. Less money ($1.50) for weight gains 3.3%-4.3%; $0.50 for 3.5%-4.5%	No effect - Reward group n=3 patients: Baseline period 4.05 SD=0.84; Incentive period 4.017 SD=0.81
Sorensen et al (2007)	Adherence to HIV HAART medication	Quasi-experiment pre/ post design	66 patients; mean age=43.3; 53% males; 95% unemployed; past adherence<80%	Escalating amount per each session total max $1172; vouchers	Medication caps as main DV (MEMS). At baseline control 52% and voucher 50% ns. During intervention, voucher 78% and control 56% (p<.0001)
Tulsky et al (2000)	Adherence to TB medication	RCT	118 patients: median age 37; 86% male; 52% African American; Homeless 50%;	$5 at each 2 weekly visits	Completion of treatment was significantly higher (p=.01) in the monetary arm (44%) than control (26%)
Volpp et al (2008)	Adherence to Warfarin medication	Quasi-experiment pre/ post	10 participants Pilot 1 and 10 participants (Pilot 2); Age>=21	Lottery expected value $5 (Pilot 1) and $3 (Pilot 2)	Pilot 1: INRs out of range decreased from 35% to 12.2%; Pilot 2: INRs out of range decreased from 65% to 40.4%

		design			
Zeng et al (2010)	Adherence to medication (diabetes)	Observational case-control	Cases n=71 Mean age 51; 57.7% female; Controls n=639 Mean age 58; 47.4% female	Change into tier 1 with flat co-payment of $10 (average co-pay before $15.3)	DV: Proportion of days covered (PDC) >=80%; Case group 75.3% before and 82.5% after reduced co-payment

Table 4.6 Included studies about treatment adherence

Authors	Target	Study design	Participants	Incentive scheme	Findings
Carey et al (2005)	Sexual risk reduction workshop	Quasi-experiment sequential design	107 participants; mean age=27; 69% African American	$30 cash	Control group attended the workshop less (9%) than incentive group (38%) (χ^2=12.88 p<.001)
Carey & Carey (1990)	Therapy for mentally ill chemical abusers	Quasi-experiment pre/ post design	53 patients; mean age=33.2; 72% males; 87% Caucasian	$3 per week gift certificate fast food or credit bowling;	Attendance higher during the incentive (32%) than baseline (9%) t(52)=2.47, p<.02.
Diaz & Perez (2009)	Drug prevention programme	Cluster RCT	211 children ages 12-13; Parents medium/ low SES	€10 voucher after 7 incentivised sessions	For the 7 incentivised sessions, controls attendance lower (M=0.0833 SD=0.509) than incentive attendance (M=0.5522 SD=1.787).
Hankin et al (1980)	Use of ambulatory psychiatric care	Observational study	55.000 patients	Increased copayment $2 to $10 per visit	Small decline in propensity to enrol in care and slight decline in utilisation rate (no raw data provided)
Helmus et al (2003)	Group counselling	Quasi-experiment pre/ post	20 patients; mean age=43.7; 75% males; 95% Caucasian	$2.50 gift certificate to local retail store twice weekly	Improved rates of attendance in experimental phase (65%) compared to baseline (45%).

		design			
Laken & Ager (1995)	Prenatal appointment	RCT	205 women; mean age 23; 56% Black; Hispanic 7%; 34% White	$5 gift certificate mailed within 1 week for each 7 prenatal appointments	No difference between groups in missed prenatal appointments. 39% of women missed one to seven appointments
Melnikow et al (1997)	First prenatal appointment	RCT	104 women; mean age=25; 55% Hispanic	Taxi voucher or Gift Baby blanket - unclear value	Control group attended less (66%) than taxi voucher group (82%); No improvement in the baby blanket gift group (54%)
Parrish et al (1986)	Child medical appointments	RCT	99 parents; majority low SES; 51% disabled children	$10 monthly lottery for vouchers ToysR'Us, McDonald or bus tokens	Parents in the control group went to initial evaluations 42% and incentive 61% ($\chi 2=7.22$ $p<.01$).
Pilote et al (1996)	First appointment for TB treatment	RCT	244 participants; median age 39-40; 81%males	$5 cash	84% of subjects in the monetary incentive completed their first follow-up vs. 53% in the control group
Post et al (2006)	Depression therapy appointments	Quasi-experiment pre/ post	50 patients; mean age=46 85% females; 96% African American	$10 cash per weekly appointment	Overall aggregate adherence was 79% during baseline and 86% during incentive period

		design			
Powers et al (2009)	Return to post-operative care	Observational Case-control	Incentive n=69; Control n=100; Mean age 6; 60.5% males; Medicaid 88.5%;	$10 check mailed after appointment	No effect - The use of $10 incentive did not improve post-operative care (65% incentive vs. 66% control) p=0.92
Reiss et al (1976)	First dental visit	RCT	35 families, 29 of them Black; mean income $5,000	$5 cash (had to mail a signed coupon to receive the money)	23% of families in the control group attended compared to 67% in incentive group
Reiss & Bailey (1982)	First dental visit	RCT	125 families with children 5-15 years old	$5 (choice of cash or gifts or credit toward parent dental care)	The control group families were less responsive (37.5%) than incentive families (84%) to initial dental visit ($\chi 2=13.65$, $p<.008$).
Rice & Lutzker (1984)	Dental clinic appointments	RCT	128 patients	Free appointment ($8) or reduced fee (50% $4)	Attendance was 70% in the control group, significantly lower than the free appointment 97% ($8) ($\chi 2=7.68$ df=1 p=.01); not different from reduced rate 87% (X2=2.45)
Rhodes et al (2003)	Counselling sessions	Quasi-experiment pre/ post	50 patients; Mean age 47 range 22-72; 52% males; 80% Black; drug addicts	Lottery of 100 tokens: 1 $100, 1 $50, 1 $25, 2 $10, 3 $5 , 46 $2.5	Participants attended 66% during baseline, no different from intervention period (71%) t(49)=-1.224 ns

Study 1		design		and 46 zero - expected value $3.5	
Rhodes et al (2003) Study 2	Counselling sessions	Quasi-experiment pre/ post design	52 patients; mean age=49; 48% males; 87% African American	$3.25 cash or lottery for 100 tokens EV $3.25	For cash: at baseline, 64% of patients attended compared to 74% during incentive. For lottery: baseline 63.5% and incentive 71%
Simon et al (1996)	Use of outpatient mental services	Observational case-control	Unclear sample	Introduction of a payment of $20 per visit	16% of likelihood of service use
Smith et al (1990)	Post-partum appointment	RCT	534 poor adolescents; mean age=15.7; 12% Caucasian	Coupon for milk for the infant or jewellery gift for mother; unclear amount	The milk coupon group had a higher compliance with 37% compared to 22% in the control group. For the gift jewellery group, 23% attendance ns.
Stevens-Simon et al (1997)	Peer-support groups for adolescent mothers	RCT	286 adolescent mothers; Age <18 years old; 44% White; 89% primigrav	$7 per weekly session	58% of those offered monetary incentives participated in peer-support groups compared to 9% of those not receiving the incentive
Stevens-Simon et	Postpartum appointment	RCT	240 adolescents; Mean age 17.5; 53.4% White;	Gift Gerry "Cuddler" – unclear price	82.4% in the incentive group compared to 65% in the control group returned for

al (1994)			75% primigravida		postpartum appointment ($\chi 2=9$ $p<.003$)
Sigmon & Stitzer (2005)	Counselling sessions	RCT	102 patients; Mean age 41; 58% males; 39% Caucasian	Lottery; Max $170 in 12 weeks; Increasing draws for first 5 sessions; Reset to one if session missed	Patients in the no-incentive condition attended on average 52%+-5% of the required sessions whereas those in the incentive condition attended 76%+-4% $p<.004$
White et al (1998)	First visit TB clinic	RCT	61 released inmates; Mean age 33; 98.4% males; 50% Hispanic	$5 cash	Rates of visit were not different from those receiving $5 plus standard education (25.8%) to those receiving just standard education (23.3%) $p=.82$

Table 4.7 Included studies about appointment keeping

Authors	Target	Study design	Participants	Incentive scheme	Findings
Chacko et al (1987)	Return visit for gonorrhoea screening	Quasi-experiment sequential design	519 participants age range 15-24 70% males almost all Black	Four lotteries of $50, $20 and 2x$15; 3 draws scheduled 2 weeks apart. Max gap to draw= 18 days	No difference in the overall test-of-cure rate as a function of lottery: 31% returned in the baseline period compared to 33% in the intervention period
Currie et al (2010)	Chlamydia screening	Observational cross-sectional	Phase I control n=2786; Phase II incentive n=866; Median age=20	$10 cash Australian Dollars	Chlamydia screening rate during Phase 1 (control) was 22.9% and during Phase 2 (incentive) 42.4%
Haukoos et al (2005)	HIV testing	Quasi-exp pre/ post design	372 participants; median age=32; 34% females	$25 cash	HIV testing in control group 8% and incentive 23% (OR=3.4 95% CI 1.8-6.6)
Kissinger et al (2000)	Return to Chlamydia screening	Quasi-exp pre/ post design	962 women; mean age=21; 96.3% African American	$20 for a 1month and 4month follow-up visits	Women who were offered incentive were 1.9 times more likely to return to any visit (CI 1.2-2.9)
Low et al (2007)	Chlamydia screening	RCT	838 participants ClaSS study UK	£10 voucher	In the incentive group 17.4% responded to screening compared to 16.5% controls ns. P=.565
Malotte	Chlamydia	RCT	285 patients	$20 cash or $20 grocery	Cash: Screening 10.75% control group vs.

et al (2004)	& Gonorrhoea screening	previous STD; mean age=22; 91.4% Black	voucher	15.1% incentive group; Voucher: Screening 12.65% control group vs. 11.3% incentive group

Table 4.8 Included studies about STI screening

4.4.2 Meta-analysis

Twenty papers were selected for this meta-analysis (N=151,875 patients) after screening for the inclusion criteria. Three of the included papers offered more than one incentive scheme: $10 cash, $10 grocery coupon and $10 fast food coupon (Malotte et al. 1999), $5 cash vs. $10 cash (Malotte et al. 1998) and $20 cash vs. $20 grocery voucher (Malotte et al. 2004). As these different experimental conditions are not independent, one incentive scheme was randomly chosen in each study (lowest in random number generation): $10 grocery coupon (Malotte et al. 1999), $5 cash (Malotte et al. 1998) and $20 cash (Malotte et al. 2004).

Most studies were performed in the US (n=18) with exception of Low (2007) and Diaz and Perez (2009). About two thirds of the studies offered incentives to participants with a low socioeconomic status (n=14)[3]. The majority of the studies incentivised patients to keep medical appointments (n=7) (Reiss et al, 1976; Reiss & Bailey, 1982; Parrish, 1986; Pilote et al, 1996; Stevens-Simon et al, 1997; White et al, 1998; Diaz & Perez, 2009). There were very few included studies targeting cancer screening (Grady et al, 1988; Slater et al, 2005), STI screening (Malotte et al, 2004; Low et al, 2007) and TB screening (Malotte et al, 1998, Malotte et al, 1999). Regarding the incentives offered, these ranged from $1 (Grady et al, 1988) to an escalating schedule of payments over $1000 (Barnett et al, 2009). Cash was the most common financial incentive used (n=9), followed by vouchers (n=7) and lotteries (n=4).

There were four cluster randomised controlled trials within the included studies, all randomizing families of children (Reiss et al, 1976; Reiss & Bailey, 1982; Yokley & Glenwick, 1984; Diaz & Perez, 2009). Odd ratios were adjusted through the ratio estimator approach by Rao and Scott (1992 in Donner & Klar, 2002) – following the same procedure as chapter 3.

Figure 4.5 shows the forest plot with a random-effects model. There was an overall positive impact of incentives (OR=3.06 CI 95% 2.04-4.57) **supporting H1** about the positive increase in health care compliance when financial incentives are offered.

[3] The socioeconomic status of participants was either clearly stated in the study (e.g., low income patients) or inferred from participants' characteristics (e.g., inner-city, deprived areas).

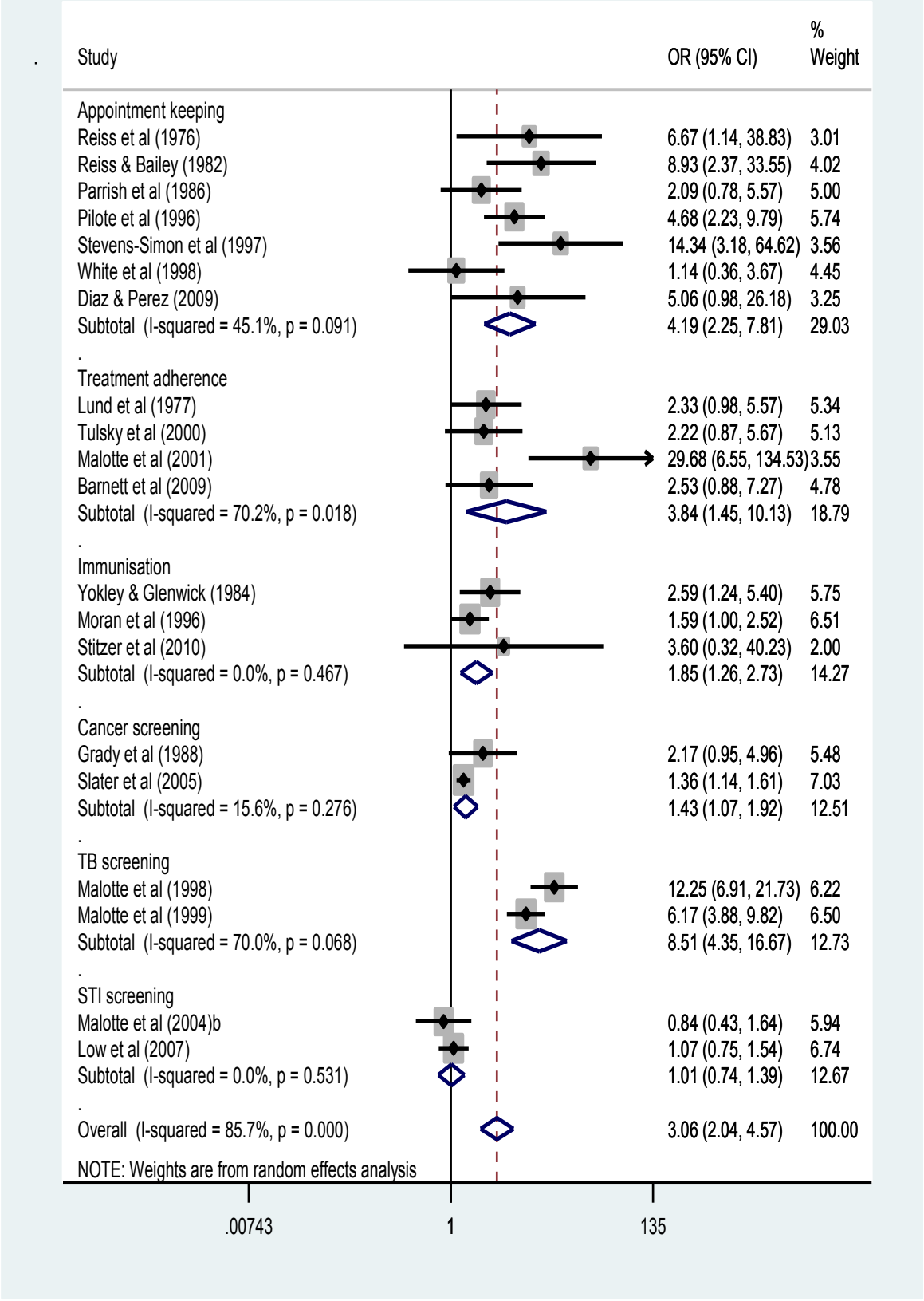

Figure 4.5 Forest plot for health care compliance

The data did not support a publication bias (Begg's test=1.73 p=.084). However, between-studies heterogeneity was high and significant (Tau2=.52; χ2=261.29 df=19 p<.001; I^2 =86%) and a small-study effect was confirmed with Egger's test (z=2.13 p=.006) i.e., the tendency for the smaller studies in a meta-analysis to show larger treatment effects.

While the random-effects model takes account of variation in effect sizes, it simply incorporates this variation into the weighting scheme—it makes no attempt to explain this variation. Thus, additional subgroup analyses and meta-regressions are needed to identify and explain the possible sources of the high between-studies variation. Subgroup random-effects analyses per health care setting showed homogeneous subgroups (Figure 4.5). Treatment adherence was the exception due to a severe outlier (Malotte et al. 2001) but its removal would eliminate the statistical heterogeneity in this subgroup (OR=2.34 CI 95% 1.36-4.05 I2=0% p=.983). Incentive interventions to promote TB screening show a high effectiveness (OR=8.51 CI 95% 4.35-16.67) as in the case of appointment keeping (OR=4.19 CI 95% 2.25-7.81) and treatment adherence (OR=3.84 95% CI 1.45-10.13). Subgroup effect sizes are smaller for immunisation (OR=1.85 95% CI 1.26-2.73), cancer screening (OR=1.43 95% CI 1.07-1.92) and the estimate is not significant for STI screening (OR=1.01 95% CI 0.74-1.39).

The subgroup analyses related to the proposed hypotheses are presented in Table 4.9 below. Results suggest that there was a negative effect of incentive size (adjusted to 2012 prices): incentives <=$5 OR=4.50 (95% CI 2.37-8.55), >$5-10$ OR=5.05 (95% CI 1.25-20.39) and >$10 OR=1.59 (95% CI 1.15-2.20). Although there seems to be a slight improvement from incentives above $5, the estimate for incentives >$5-10$ has a wider confidence interval and very high heterogeneity (I^2=94.2%). The estimates for the lower (<=$5) and higher incentives (>$10) have narrower confidence intervals and the latter has high reliability with no significant between-study heterogeneity.

Cash appears to be more effective (OR=3.94 95% CI 1.84-8.46) than vouchers (OR=2.24 95% CI 1.04-4.85) and lotteries (OR=1.90 95% CI 1.37-2.65). The data also suggest a tendency for incentives to be offered immediately to be more effective (OR=3.26 vs. 2.11).

The effect size of incentives when offered to patients of a low socioeconomic status is more than double than the effect size for more affluent patients (OR=3.98 95% CI 2.16-7.34 versus OR=1.5 95% CI 1.06-2.13). The analysis also included the effect of

the recipient and location simply as background variables – thus not included in my main hypotheses. Results suggested a slightly higher effectiveness of incentives offered for the compliance with health guidelines for children (OR=3.05 95% CI 1.99-4.68 versus adults OR=2.57 95% CI 1.59-4.17) and offered to patients in the United States (OR=2.97 95% CI 1.92-4.58 versus Europe OR=1.88 95% CI 0.43-8.12).

Odds Ratio (95% CI)			**Nº studies**
Incentive size	<=$5	4.50(2.37-8.55)	N=9
	>$5-10$	5.05(1.25-20.39)	N=6
	>$10	1.59(1.15-2.20)	N=5
Incentive scheme	Cash	3.94(1.84-8.46)	N=9
	Vouchers	2.24(1.04-4.85)	N=7
	Lottery	1.90(1.37-2.65)	N=4
	Immediate delivery	3.26(1.69-6.25)	N=12
	Delayed delivery	2.11(1.39-3.20)	N=8
SES	Low SES	3.98(2.16-7.34)	N=14
	Otherwise	1.50(1.06-2.13)	N=6
Recipient	Children	3.05(1.99-4.68)	N=5
	Adults	2.57(1.59-4.17)	N=15
Location	USA	2.97(1.92-4.58)	N=18
	Europe	1.88(0.43-8.12)	N=2

Table 4.9 Subgroup analyses for health care compliance

Meta-regression analyses in Table 4.10 tests if these differences are significant in explaining the heterogeneity found in the overall estimate. Four meta-regression analyses were performed by category of moderators (Table 4.10) taking in consideration the recommendations that there should be a limited number of covariates per meta-regression analysis (Thompson & Higgins, 2001). The meta-regression coefficients are taken as the evidence for the hypotheses proposed for effect modifiers. **Hypothesis 2** about incentive size was not confirmed. In fact, the data suggests a negative effect of the size of the incentive. Incentives higher than $10 are less effective than incentives equal or inferior to $5 using the more liberal 10% significance level (B=-.892 p=.09). **Hypothesis 3** about cash being more effective than goods-based incentives, **hypothesis**

4 about the incentive certainty and **hypothesis 5** about the incentive immediacy are also not supported (B=-.571 p=.159, B=-.404 p=.406 and B=.030 p=.953).

From the set of hypotheses proposed, **hypothesis 7** is the only one clearly supported. The offer of financial incentives strongly increases health care compliance for low income patients compared to other participants (B=-.898 p=.023). This variable explains about 30% of the variability found in the impact of financial incentives.

As already discussed in the qualitative review, there are not enough studies available in the literature to test **hypothesis 6** (about the effect of negative incentives) and **hypothesis 8** (about previous compliance behaviour).

Hypothesis		Coefficient (SE)	p-value	95% CI	
2	Incentive Size (baseline <=$5)				
	>$5-$10	.046(.532)	.933	-1.078	1.169
	$10+	-.892(.496)	**.090**	-1.938	.155
3	Incentive Type (0=cash)	-.571(.388)	**.159**	-1.390	.247
4	Incentive Certainty (0=lottery)	-.404(.473)	.406	-1.402	.595
5	Incentive Delivery (0=immediate)	.030(.506)	.953	-1.055	1.116
7	Patient Income (0=low) (AdjR^2=29.4%)	**-.898 (.359)**	**.023**	-1.656	-.139
	Health setting (AdjR^2=90.5%)				
	Appointment keeping	**1.401(.346)**	**.001**	.653	2.150
	Treatment adherence	**.865(.397)**	**.048**	.007	1.723
	Immunization	**.675(.355)**	**.08**	-.092	1.442
	Cancer screening	.413(.325)	.226	-.289	1.116
	TB screening	**2.133(.347)**	**.000**	1.382	2.883

Table 4.10 Meta-regression analyses for health care compliance

The meta-regression analyses showed the health care setting was the most important moderator of the effectiveness of patient incentives, explaining an overwhelming proportion of the heterogeneity found in the data (adjusted R^2=90.5% F(5,13)=9.64 p<.001). Compared to STI screening (baseline category), financial incentives are effective to increase TB screening (B=2.13 p<.001), appointment keeping (B=1.4 p=.001), treatment adherence (B=.86 p=.048). The coefficient for immunisation is significant at .1 significance level (B=.675 p=.08). According to the results of this

review, patient financial incentives are not effective to promote cancer screening (B=.41 p=.226) and STI screening.

However, differences in the incentives offered in each health setting may be acting as confounding variables. I examined this question doing a simple aggregation of health settings according to the significance of the impact of incentives (Table 4.11). Given the small numbers of papers per group, I performed nonparametric tests comparing (i) the average incentive size offered in the studies, (ii) the proportion of cash-based incentives and (iii) proportion of studies with samples mostly composed by low income participants. I used these variables as comparators in concordance with meta-regression results, which suggested these three factors as the most influential. Results showed that the studies included in the health settings where incentives were effective, offered smaller incentives ($9.46 versus 47.86 p=.037) and were predominantly interventions targeting low income participants (92.4% of the studies p=.007).

Health settings	**Incentive size ($)**	**% Cash**	**%low SES**
Incentives were effective ($N_{studies}$=13)	9.46	69.2%	92.3%
Incentive were not effective ($N_{studies}$=7)	47.86	57.1%	28.6%
	Mann-Whitney U test p=.037	X^2=.292 p=.474	X^2=8.802 p=.007

Table 4.11 Differences in the incentive offered and patient income per health settings

4.4.3 Assessment of risk of bias

Risk of bias was substantial in many studies included in the meta-analysis. Details about the method used for randomization were described in only two studies (Slater et al, 2005; Low et al, 2007 both using generation of random numbers). Allocation concealment was unclear in all trials as well as the blinding of participants and supporting staff. With respect to baseline comparability, three in 20 studies (Barnett et al, 2009; Malotte et al, 2004; Moran et al, 1996) provided an adequate comparison. None of the four cluster trials (Reiss et al, 1976; Reiss & Bailey, 1982; Yokley & Glenwick, 1984; Diaz & Perez, 2009) adjust their estimates according to the group-level nature of the data. Four of the 20 included studies were first-authored by the same

scholar (Malotte et al, 1998; 1999; 2001; 2004) which can be considered a violation of data independence. On a positive note, there were no studies with incomplete data reporting or selective presentation of results.

The difference in the quality of trials and their associated risk of bias is reflected in the smaller effect size estimates (OR=1.42 95% CI 1.13-1.79 vs. OR=3.65 95% CI 2.19-6.09 p=.045 B=-.81 p=.045) of higher quality studies (Slater et al, 2005; Low et al, 2007; Moran et al, 1996; Malotte et al, 1999). The data did not support a publication bias (Begg's test=1.73 p=.084) but a small-study effect was confirmed with Egger's test (z=2.13 p=.006).

I present a funnel plot in Figure 4.6 below as a visual representation of a small-study bias. Funnel plots are simple scatterplots of the treatment effects estimated from individual studies (horizontal axis) against a measure of study size (vertical axis). Standard error in the *y* axis is used as the measure of study size (Harbord et al 2009 in Sterne, 2009). Treatment effects in the *x* axis are plotted on a log scale. Interpretation of funnel plots is facilitated by the inclusion of diagonal lines that represent 95% confidence limits around the average estimate and delimit the expected distribution of studies in the absence of heterogeneity or biases. This funnel plot shows high dispersion in the estimates, suggesting two distributions of studies.

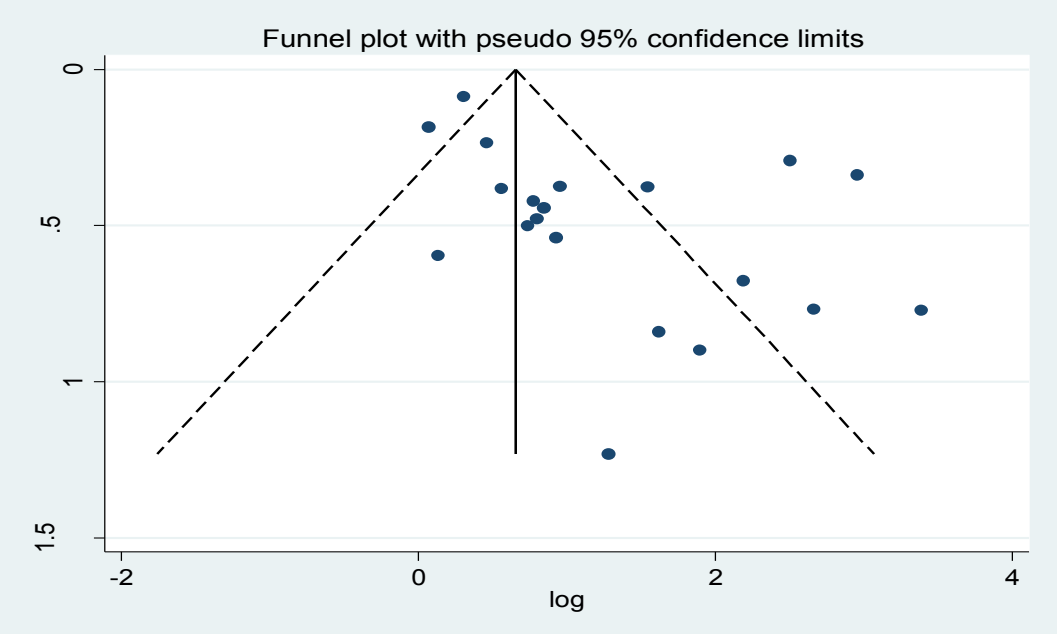

Figure 4.6 Funnel plot

This visual insight is confirmed with test for funnel plot asymmetry (Hardbord et al, 2009 in Sterne, 2009), which examine whether the association between the estimated effect of incentive interventions and sample size is greater than chance. The Harbord's test for small-study effects confirmed a bias introduced by small studies (2.251 p=.04). Therefore, more reliable estimates are given by larger studies (lower standard error) reporting lower effect sizes for incentive interventions. Very high effect sizes fall outside the 95% confidence interval - these lines are not strict 95% limits and thus are referred to as pseudo 95% confidence limits (Sterne, 2009).

This difference is visually present in Figure 4.7, the funnel plot adjusted for sample size, comparing studies with sample sizes below and above N=200. Larger studies are clustered around the null effect and smaller studies spread across a wide range of effect sizes. This means that the more conservative estimate from larger studies (N>200) (OR=1.42 95% CI 1.13-1.79) is likely to be more representative of the 'true' effect of incentives to promote compliance than the unadjusted estimate (OR=3.06).

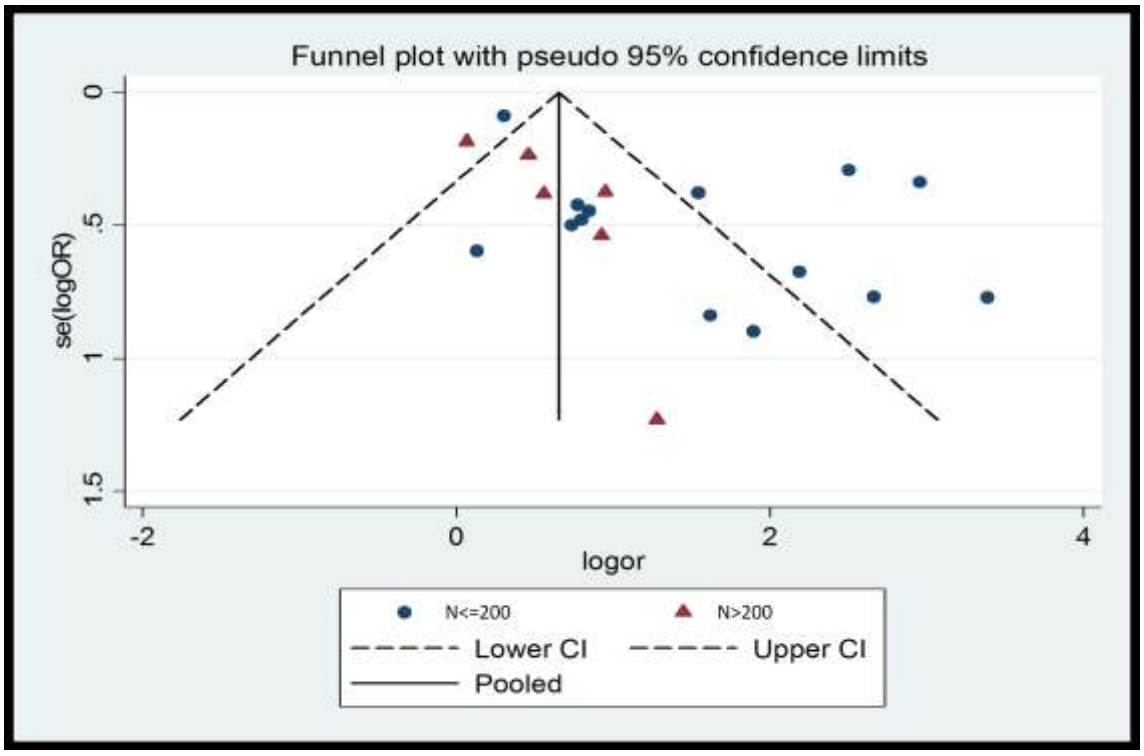

Figure 4.7 Funnel plot adjusted for sample size

4.5 Discussion

I presented the first piece of evidence quantifying the impact of patient financial incentives to increase health care compliance in the general population. Results from a random-effects meta-analysis showed an overall positive impact of financial incentives: patients offered a financial incentive are about 40% (OR=1.42 95% CI 1.13-1.79 assuming a conservative estimate) more likely to comply with health care recommendations (supporting hypothesis 1). Contrary to initial predictions, most characteristics of the incentive schemes had no significant impact. Incentive size was the only incentive feature marginally significant at a .1 level, with a negative impact in the likelihood to comply with health care. In addition, the socioeconomic status of patients was the single effect modifier initially hypothesised that significantly explained at a 5% significance level the variability found in the impact of incentives (hypothesis 7). Low income patients (by comparison to more affluent patients) were 2.5 times more likely to comply with health care when offered a financial incentive. I discuss below the results in greater detail.

Firstly, the tendency for a negative effect of incentive size is concordant with an emerging literature on behavioural economics showing there is a complex relationship between incentives and behaviour (e.g., Pokorny, 2008; Ariely et al, 2009) – although it is still unclear the exact profile of this relationship. In the health settings under consideration, it seems that people want to get paid but not too much. A possible explanation for this tendency is that higher incentives increase perceived risk by signalling a potential threat e.g., a painful cancer screening procedure or a harmful vaccine. An alternative justification is that, under the offer of small incentives, people maintain their perception of autonomous behaviour, whereas higher incentives draw attention to the external control of patients' decisions. This pattern in the results suggests that increasing the incentive size much over $10 (£5) could eventually crowd-out health behaviour.

Interestingly, this effect is not consistent with the results from Lussier et al (2006) in their meta-analysis, showing a positive monotonic effect of incentive size for drug abstinence. This difference may be indicative of the moderator role of the type of population: clinical (with diagnosed addiction problems) populations are more sensitive to the magnitude of rewards and punishments (Garavan & Weierstall, 2012). Or it is also possible that this difference corroborates the division between behaviours that require an immediate cost (as the behaviours examined in this work) and behaviours

that require an immediate withdrawal of reward (as drug abstinence, smoking cessation or healthy eating that were excluded from the analysis), more responsive to the size of compensatory rewards.

A different explanation of this adverse effect of incentive size is unrelated to the amount of the incentive. It could be a question of reverse causation: health settings in which patients are known to be more resistant to comply may drive health providers to offer larger incentives, that are ultimately not effective because of baseline complex barriers associated with the specific nature of the health settings e.g., fear of painful cancer screening.

Secondly, the socioeconomic status of patients was the single effect modifier significant at the conventional significance level. The higher impact of incentives in patients facing high economic deprivation may raise different points of view. On one hand, it puts forward the possibility that incentives could be used as a policy tool to tackle health inequalities (Oliver & Brown, 2012). This is a particularly important question because there is a call for tailored health interventions that acknowledge the specificities of different social groups (Michie et al, 2009). Interventions to promote health behaviour have been shown to adversely increase health inequalities, because often rely on assumption of knowledge promotion and goal setting, that may not necessarily fit the needs of deprived, poorly educated individuals (idem). But to others, this may imply that low income people feel coerced to comply with health organisations when incentives are offered (Parke et al, 2011) and, exactly because incentives have such a great impact in low income people, they should not be offered.

Both incentive size and patient socioeconomic status appeared to be associated with the substantial variability explained by the health setting under analysis. Although not subject to *a priori* hypotheses, the health setting in which incentives were offered explained about 90% of all heterogeneity found in the effectiveness of incentive offers. Incentives were shown to highly increase the likelihood to comply with TB screening and to lesser extent, appointment keeping and treatment adherence – there was a marginal positive impact for immunisation. However, patient financial incentives were not effective in promoting cancer and STI screening. Analysing the differences between the health settings in which incentives were and were not effective, results showed that a significant impact was found in health settings with average offers under $10 and mostly targeting low income participants. This simple analysis should be interpreted as an observed pattern and not a robust statistical because of the small number of studies

included and the absence of causality in meta-analysis results. Nevertheless, it seems to corroborate the impact of patient deprivation and low value offers in effectiveness of incentive interventions in health compliance.

The disparity in the impact of incentive interventions per health behaviour could also suggest that incentives are more effective and/or appropriate in addressing some barriers to compliance than others. Financial incentives may not be sufficiently motivating to overcome intricate barriers involving fear, anxiety or lack of trust in the health services – barriers typically reported for low compliance with STI and cancer screening (Guessous et al, 2010; Waller et al, 2009), contexts which were found here to be resistant to incentive offers. Low rates of appointment keeping are usually caused by simple and uncomplicated reasons like time constraints or memory lapses (Paige & Mansell, 2013), which may be easily surmounted by by the offer of an incentive – as my results strongly support for this setting of appointment keeping. This rationale poses an important cost-effectiveness question though. If it is the case that financial incentives are effective only in health settings where minor barriers to compliance have been identified, it is reasonable to assume that alternative nonfinancial interventions for simple barriers such as reminders or opportunistic screening (which have been proven effective e.g., Michie et al. 2008) should be preferred.

The fact that none of the hypotheses about the characteristics of the incentive scheme were confirmed at the conventional level of significance raises the question about the predictive validity of the behavioural science underlying most of the hypotheses. Are standard incentive interventions enough? A result showing a positive effect of incentives without a significant impact from incentive scheme features is concordant with standard economic theory and there seems to be no need to resort to behavioural economics.

This is not how I interpret these results. On one hand, the negative effect of incentive size clearly points to the need for explanations outside the realm of standard economics. On the other hand, the fact that no significant differences were detected may expose a true effect or it may be indicative of too much heterogeneity within each type of incentive category. For instance, let us assume that people have a strong preference for both cash and incentives offered with certainty. If most cash incentives were offered in the form of lotteries and most incentives offered with certainty were vouchers or coupons, treatment effects can be cancelled if one of the preferences is not dominant. Considering the variety of settings and populations included, this is a plausible

justification. And these subtleties cannot easily be disentangled in meta-analysis. I will further examine this question in the next chapter.

An alternative explanation is that incentives people may consider most appealing – e.g., cash payments or thrilling lotteries – may not be considered suitable for health settings. Previous individual randomised controlled trials testing the difference between cash-based and goods-based incentives have shown that cash is more effective (Deren et al, 1994; Malotte et al, 1999; 2004; Kamb et al, 1998; Tulsky et al, 2004; Vandrey et al, 2007). But most of these studies were performed in the context of TB screening – usually targeting low income men – for which cash may be the best offer. Meta-regression estimates include studies that have offered cash not only to promote TB screening but also other health care behaviours for which the target population may not find cash an appropriate offer. Research on the public acceptability of incentives (Promberger et al, 2012) has shown that cash may be not considered acceptable in all circumstances and, for this reason, be less effective than expected in changing behaviour.

On a different note, no difference was found between immediate (versus delayed) incentives (hypothesis 5). This result also contradicts the work of Lussier and colleagues (2006) on drug abstinence, showing a higher impact of incentives delivered immediately after behaviour. Similarly to the discussion made for incentive size, it is not clear if the lack of effect found here is due to incentives being offered to the general population with tends to have lower discount rates than clinical patients (MacKillop et al, 2011) or the type of behaviour in analysis. Assuming this indifference between immediate versus delayed incentives as a true effect, this may be useful to health organisations which are not always able to deliver incentives on-site. Incentives may only be offered after clinical results are available or only after some proof of compliance has been be delivered – and according to my results, postponing incentive deliver may not make a difference.

It was not possible to test in the meta-analysis the effectiveness of negative versus positive incentives (hypothesis 6), despite the centrality of this debate in the literature (Marteau et al, 2009; Promberger et al, 2011), mostly influenced by the concept of loss aversion from prospect theory. There were only two other studies using penalties to change health behaviour, both related to penalties imposed to parents for lack of child immunisation. One study showed that no effect of this sanction (Minkovitz et al, 1999) but the other study (Kerpelman et al, 2000) found a significant impact of the

penalty. There are no studies directly comparing the impact of rewards versus penalties in health contexts. Cost-sharing studies (e.g., Meeker et al, 2011; Chernew et al, 2008; Maciejewski et al, 2009; Atella et al, 2006) provide numerous examples of the impact of increasing or decreasing copayments but (i) do not directly compare these different types of incentive in the same study and (ii) are mostly based on observational data.

In addition, there was not sufficient data to analysis the difference between patients with different baseline adherence levels (hypothesis 8). There was a single RCT examining this difference (Stoner et al, 1998) and showed that the positive impact of incentives was mostly due to its effect on previously non-compliant patients. Incentives had no impact for patients already engaged with health care services. Nevertheless, this is still an isolated piece of evidence.

As a background variable, it was also analysed the impact of study location. It could also be expected that incentives would have a higher impact in the US compared to the Europe because in the US most studies offered incentives to decrease or eliminate the costs of medical compliance that patients had to incur, whereas in Europe, incentives were offered as means to increase compliance to services that were already free of charge. Subgroup analyses showed a difference in this predicted direction.

4.5.1 Limitations

A possible limitation of this work is the variability of health contexts included and incentives offered, which may hinder the argument for an overall estimate. However, with several subgroup and meta-regression analyses, I believe to have sufficiently addressed the heterogeneity of the data and uncovered reliable results. One of the main pitfalls of meta-analysis is data dredging (Thompson & Higgins, 2002). This can only be avoided by pre-specification of covariates that will be investigated as potential sources of heterogeneity and this was done by proposing several a priori hypotheses to be tested.

Another important point to stress is the considerable risk of bias that characterized many of the included studies. Studies at lower risk of bias provided a significantly smaller estimate for the impact of incentives which can be considered a more reliable effect size that the overall estimate (OR=1.42 95% CI 1.13-1.79 versus OR=3.06 95% CI 95% 2.04-4.57) and thus, the expected overall impact of incentives is likely to be smaller than the estimate not adjusted to study quality. Nevertheless, even based on a conservative estimate, incentives are likely to increase compliance by 42%.

Directly related to the point above mentioned, is the question of the boundaries in the definition of health care compliance. Although it can be considered that other behaviours could fit under the umbrella of health care compliance – defined as following medical guidelines - the included health behaviours share an immediate and relatively low cost to be borne in the present to achieve future health benefits. Contrary to smoking cessation (which requires an immediate withdrawal of a present reward) or exercise activities (which represent a present cost but more effortful and prolonged), the health contexts we analysed fall within a coherent category of health care compliance. This is a particularly compelling argument because no significant heterogeneity was found within-studies per health setting.

4.5.2 Implications for future research

The assessment of risk of bias exposes the need for well-designed, high powered randomised controlled trials to provide more accurate estimates of how much incentives change health. Future studies should also address the role of psychological characteristics in the response to incentives. There is a residual variability in the results that remains to be explained and it is likely that the idiosyncrasies of patients such as attitudes towards incentives (Promberger et al, 2011), sensitivity to rewards (Cooper & Gomes, 2008) or time preferences (Scharff & Viscusi, 2011) are important in understanding the effectiveness of financial incentives.

The fact that incentive schemes characteristics such as type, size and delivery schedule did not reach significance as moderators of incentive effectiveness does not necessarily imply that these should be overlooked. On the contrary, more research is needed to understand if these features are truly irrelevant or if, to date, studies have not been sufficiently informed by behavioural research to make a difference. In the next chapters 5 and 6 I will further examine some of hypotheses that were not supported here using as research contexts STI screening and cancer screening – the two health settings for which no significant impact of incentives was found in the meta-regression. In both cases, a particular attention will be given to the development of the incentive schemes to clarify if the characteristics of the incentive offers are more effective when theoretically grounded.

Chapter 5

Vouchers versus Lotteries in Chlamydia Screening

In this cluster randomised trial (N=1060), I tested the impact of financial incentives (£5 voucher vs. £200 lottery) framed as a gain or a loss to promote the uptake of Chlamydia screening – the leading STI in the UK. Compared to a control group (1.5%), the lottery increased screening to 2.8% and the voucher increased screening to 22.8%. Incentives framed as gains were marginally more effective (10.5%) that loss-framed incentives (7.1%) (p=.069) to increase Chlamydia screening.

This study makes an innovative application of prospect theory to sexual health behaviour and health interventions. By comparing the impact of a small voucher with a larger lottery – framed as a gain or a loss - I test the predictive validity of prospect theory to change behaviour. To the best of our knowledge, this is the first attempt to examine these questions. Furthermore, it mimics the standard outreach approach used in student halls in the UK thus providing an estimate of the effect size for similar interventions if implemented – with and without the offer of an incentive.

5.1 Incentives as a common tool to promote Chlamydia screening

The systematic review and meta-analysis in chapter 4 showed – overall – a positive effect of incentives but no significant impact of the characteristics of the incentive schemes offered to patients. These results are consistent with standard economics and there has been no particular need to resort to the standpoint of behavioural economics. However, this chapter and the following (Chapter 6) examine the robustness of these results when incentive interventions are theoretically grounded. I show in the next two field studies that the type, size and timing of the incentive do matter. This leads me to propose that the lack of effect from incentive features in the meta-analysis for compliance may be due to a heterogeneous combination of positive and adverse effects of incentive offers cancelling each other – adverse effects which can be identified and explained by behavioural science. I will pick up on this premise in the general discussion (chapter 7).

The present study tests a 2x2 factorial design intervention based on prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992) to increase the uptake of Chlamydia screening. Chapter 4 also exposed the small number of experimental studies that tested the impact of incentives to promote STI screening and, from the limited available evidence, found no support for the use of financial incentives in this context. I examine the impact of two financial incentives - a voucher (£5) versus a lottery voucher (£200) – the two most common types of financial incentives used in the field by health organizations to promote Chlamydia screening (Zenner et al, 2012). I will provide a direct comparison of the same type of incentive (voucher) offered with certainty or uncertainty. These incentives will be framed either as a potential gain or a loss to participants, introducing a variation in the incentive offer that has been seldom used in health interventions. Reinstating one core motivation of this work, I will test if changing the salience and framing of the incentive offer changes its impact on behaviour.

This study makes an innovative application of prospect theory to health interventions. By comparing the impact of a small voucher with a larger lottery – both framed either as potential gains and losses - I will be testing the predictive validity of prospect theory to change behaviour. To the best of our knowledge, this is the first study operationalising prospect theory concepts in the design of behavioural field interventions. Furthermore, it mimics the standard outreach approach used in student

halls in the UK thus providing an estimate of the effect size of similar interventions if implemented – with and without the offer of an incentive.

Chlamydia screening was the research context chosen for this study because Chlamydia is the most common STI in the world and has been the leading STI in the UK since 2000 (Low et al. 2013). The National Chlamydia Screening Programme (NCSP) was introduced in England in 2003 for sexually active young people under 25 years old. However, the uptake of screening tests has been low, despite being offered free of charge to individuals. Only 10% to 20% of young people who are eligible to perform the test actually do it (Zenner et al, 2012), forgoing the opportunity of early detection and leading to a waste of public resources. Screening rates of young people outside the UK are also low (Berry et al, 2010; Low et al, 2012) which amplifies the relevance of this work outside UK borders. The largest proportion of cases in the UK is found among young people aged 18-25 years old living in London (Health Protection Agency, 2009) and these cases account for two thirds of all Chlamydia diagnoses in the country. Chlamydia is often referred to as the 'silent infection' as it tends to have no symptoms but, if left undiagnosed, can cause severe reproductive, skin and visual problems.

Most interventions to date have tried to promote the screening uptake by increasing awareness to the incidence of the disease or by targeting practitioners with educational packages but the effectiveness of these interventions has been negligible (Ginige et al, 2007; Guy et al. 2011). The common causes reported by individuals for low screening rates are fear of stigma and embarrassment about performing a sexual health test - particularly regarding what other people might think - and anxiety about having to inform partners in a case of a positive result (Duncan et al, 2011; Mills et al, 2006; Richardson et al, 2010). The offer of a financial incentive may also mitigate the embarrassment of performing STI screening because the presence of an incentive allows for external attributions of behaviour (Sabini et al, 2001; Burger and Caldwell, 2003). Incentives, as a salient external stimulus, may justify behaviour and act as a public validation for STI screening.

Financial incentives have increasingly been used by Primary Care Trusts (PCTs) in the UK to tackle the problem of low screening rates of Chlamydia (Health Protection Agency, 2009). With the purpose of evaluating the impact of incentives in Chlamydia screening in the UK, Zenner and colleagues (2012) examined observational data comparing the screening rate of PCTs offering incentives with control PCTs matched by

socio-demographic characteristics (population size and deprivation level) and baseline screening coverage (2007-2009). Forty-six of the 152 PCTs in England had used a total of 65 incentive schemes to increase Chlamydia screening coverage. The majority of incentive offers (62%) were prize draws ranging from a £50 voucher to a £500 holiday trip. The remaining schemes used smaller incentives as vouchers or coupons, which ranged in value from £5 to £10. Most incentives were delivered through outreach work (55%). Results showed that differences in average percentage point changes in screening coverage were significant (0.43%, CI 0.04%-0.82% p=.03), due to voucher schemes (2.35% p<.0001) but not lotteries and draw prizes (0.16% p=.4). Furthermore, the impact of vouchers was more accentuated in females (3.18% p<.0001) than males (1.55% p=.001).

Nevertheless, while the observational evidence from Zenner and colleagues (2012) suggested that these schemes seem to make a difference, no causal inferences can be made from these results. Other observational studies (Currie et al, 2010; Martin et al. 2012) also report a positive impact but there is scarce experimental work to corroborate this evidence. Experimental evidence in the UK is restricted to a couple of papers. Low and co-workers (2007) found no impact of offering a £10 incentive when inviting a random sample of young people to perform screening. Dolan and Rusidill (forthcoming) also found no effect of offering £5 or £10 voucher incentives for kit return to young people who had requested a screening kit online. The authors reported high levels of kit return (because these participants were already motivated to perform the test) but no improved return for participants offered an incentive. The remaining experimental study on Chlamydia screening was developed in the US (Malotte et al, 2004). Participants were offered either $20 cash or a $20 grocery voucher but only cash was effective. These experimental studies raise the question about the generalisability of Zenner and colleagues' (2012) results.

In general, most incentive schemes ran so far, although showing some degree of effectiveness, have no clear theoretical motivation. The development of theoretically driven schemes, particularly if tested in the field, may improve our understanding of which types and framing of incentives work, and enhance our ability to promote health behaviour change. According to Zenner et al (2012), the most common incentives used are small vouchers valued £5-£10 and lotteries ranging from £50 to £500. Thus, I will be testing the relative impact of a voucher (£5) versus a lottery voucher (£200). The comparison of a £5 voucher with a £200 lottery cannot be taken as a direct test of

overweighing of small probabilities (Kanheman & Tversky, 1979) because this would require two lotteries with similar expected value but different probabilities. Nevertheless, my work will shed light on the impact of a small certain versus a higher uncertain incentive of the same type – a voucher.

Very few interventions have used incentives in the form of lotteries to promote health care compliance but these have generally reported positive results in various health settings (Sigmon and Stitzer, 2005; Volpp et al. 2008). The exception was the offer of lotteries in a STI context where no significant increase was found for Gonorrhoea screening (Chacko et al. 1987). This may indicate that STI screening is particularly resistant to financial incentives and to lotteries in particular. The observational data from Zenner and colleagues (2012) found that vouchers (but not lotteries) had a positive impact, suggesting a preference for certainty in this context (Kahneman & Tversky, 1986).

Another feature of prospect theory, loss aversion, will be examined by framing the incentive offer either as a potential gain or as a potential loss. The concept of loss aversion is related to the fact that people are more sensitive to losses than gains of an equal value. The same outcome is valued differently if framed as the prospect of a gain or a loss in relation to some reference point. This idea, initially developed in the context of financial gambles, became very influential in health communication research (Gallagher & Updegraff, 2012). Message framing aims to provide a theoretically grounded development of effective health messages, mostly based on results from prospect theory (Rothman et al, 2006). Messages emphasizing the costs of not behaving in a healthy manner are designated as loss-framed whereas communications highlighting the benefits of engaging in healthy behaviour are referred to as gain-framed (Rothman & Updegraff, 2010). Heavily influenced by the predictions of loss aversion in the case of risky financial decisions, research on health messages often assumes that loss-framed messages are more effective in promoting behaviour change (Rice, 2013). The evidence is mixed, however, and there is no clear support for the superiority of loss-framing.

Studies tend to divide the analysis by illness prevention versus illness detection: examples of preventive behaviour are smoking cessation, safe sex or sunscreen use, whereas detection is related to STI screening or cancer screening. There is some consensus that gain-framed messages are more likely to encourage prevention behaviours (Kiene et al, 2005; O'Keefe & Jesen, 2008, 2009; Gallagher & Updegraff,

2012) but results with respect to illness detection are not conclusive. Some studies support the use of loss-framed messages to increase screening (O'Keefe and Jensen, 2009; Rothman et al. 1999, 2006; Kiene et al, 2005) but more recent papers fail to find any association (Alk et al, 2011; Gallagher & Updegraff, 2012). Regarding Chlamydia screening, Urban and co-workers (2006) evaluated the impact of gain versus loss-framed messages in the intention to obtain screening and reported no difference between the two types of messages. This study was based on self-reported intention to screen and thus it is yet to be shown the impact of framing on actual Chlamydia screening rates.

But if research on the framing of health outcomes is extensive, the framing of incentive messages is under-researched. Patients can be offered the possibility to gain a reward for screening and bear a loss in the absence of screening. And this is a different application of framing effects compared to previous research which has mostly *framed outcome information,* that is, what is framed is the result of people behaving or not in a healthy manner. Despite the existence of some studies about incentive framing in other settings (Etchart-Vicent & l'Haridon, 2011; Madhavan et al, 2012), suggesting that loss-framed incentives are stronger motivators, within health research there is scarce evidence.

A couple of studies compare the different impact of offering successive gains with deducting successive losses from an initial endowment but most evidence comes from smoking cessation interventions (Gine et al, 2010) - which may not be directly transposable to STI screening. In a study by Romanowich and Lamb (2013), participants could either gain $75 per day or lose $75 per day (initial endowment=$375). Loss-framed participants were more likely to achieve at least one day abstinence and tended to reduce the amount smoked more than gain-framed participants. But in opposition, Roll and Howard (2008) found a positive effect from gain-framed incentives in smoking abstinence and an adverse effect from loss-framing.

These limited and contradictory results call for further clarifying studies. Moreover, although both these studies are informative about the impact of incentive framing, both cases involve real gains and losses, not strictly framing effects.

This study makes an innovative application of Prospect theory to sexual health behaviour and health interventions. By comparing the impact of a small voucher with a larger lottery – framed as a gain or a loss – I make an attempt to test the impact both the certainty effect and loss aversion from prospect theory to change health behaviour. I

contribute to the literature by examining these questions in combination and providing evidence from the field.

5.2 Hypotheses

The hypotheses for this study are the following:

Hypothesis 1. The uptake of Chlamydia screening will be higher in incentive groups.

This hypothesis is derived from standard economics and operant conditioning (Gneezy et al. 2011; Kleinsorge and Rinkenauer, 2012) in that *ceteris paribus* an incentive will increase the likelihood of behaviour occurence.

Hypothesis 2. A £5 voucher will increase the uptake of Chlamydia screening more than a £200 lottery.

The certainty effect (Tversky & Kahneman, 1986) and previous observational studies using incentives in sexual health (Chacko et al. 1987; Zenner et al. 2012) suggest a small certain incentive will be more effective than a prize draw.

Hypothesis 3. Loss-framed incentives will be more effective than gain-framed incentives to increase the uptake of Chlamydia screening.

This hypothesis is derived from prospect theory and the concept of loss aversion (Tversky and Kahneman, 1979, 1992).

5.3 Method

5.3.1 Sampling and sample size calculations

The study was approved by the LSE Ethics Committee. This study followed CONSORT guidelines for cluster RCTs (Campbell et al. 2004). Participants in this study were individuals aged 18-24 years living in student halls in London (n=1060) as the core target population of the National Chlamydia Screening Programme in the UK. Four halls from three different Universities agreed to participate in this study. To avoid treatment contamination (i.e., students becoming aware of different incentives being offered to others), each hall was randomly selected to receive a different type of incentive.

Due to the clustered nature of the sample, power calculations were necessary to evaluate the design effect of the study. The design effect is the amount by which the sample size should be multiplied. This amount depends on how much more alike individuals are within a given cluster (=hall) than those from different clusters, designated by intraclass correlation coefficient or ICC (Wade and Koutoumanou, 2011).The lower the coefficient, the more individuals from different clusters are similar. There is no objective measure for the ICC in this study and there are no similar previous studies to serve as benchmark. I establish ICC at .01 because participants, although living in different halls, are all undergraduate students under 25 living in London with no significant age difference between halls (95% of students within the 18-24 range, mean 20.19 SD=2.9) and a similar mix of socio-demographic characteristics (gender and ethnicity). The average number of individuals per cluster was 265 resulting in a design effect of 3.641[4]. This would correspond to n=73 per hall in a design with simple randomisation which has, at a .05 significance level, 80% power to detect around a 10% uptake difference between groups.

Regarding the gain versus loss framing of the incentive offered, there was a simple randomisation within-hall by room number (coin flip determined even numbers=loss framing; odd numbers=gain framing). In each hall, only one type of incentive was offered (£5 voucher or £200 lottery) but this was framed as a gain to half the students and as a loss to the remaining half. In the leaflet distributed to students (see procedure below) this difference is not easily detected even if students discussed the offer of the incentive among each other because the salient features (type and size of incentive) remained the same (Appendix 3).

Although this study has four experimental conditions (2 framing x 2 type of incentive) and control group, only the type of incentive (voucher or lottery) required cluster randomisation between-halls. Therefore, the four halls were randomly selected to test the offer of the voucher, the lottery or no incentive. As there were three intervention arms and four halls, two halls needed to have the same intervention. Random number generation allocated the halls to interventions: the lowest number would be the control group, the second lowest number was attributed the lottery and the two highest numbers corresponded to the voucher offer.

[4] Design effect=1+(average number of individuals per cluster-1)xICC)

5.3.2 Procedure

The National Chlamydia Programme in the UK works mostly through opportunistic screening i.e., when young people register with the NHS or visit their GP for different reasons. Students living in halls are mostly approached through a proactive strategy by outreach organisations that offer free screening on site (Jenkins et al. 2012). Zenner and colleagues (2012) confirmed that most incentives schemes were offered through outreach work (55%) and thus this is also the strategy used in this study.

Chlamydia information leaflets were placed under each student's individual room door. All leaflets include the standard NHS Chlamydia information that appears in NHS informational brochures related to the infection. Experimental groups received additional information about the incentive offer. The students were invited to pick up a test in their hall's reception, perform the test in their rooms and return it to the reception on the same or next day. The test consisted in proving a urine sample in a plastic cup. This direct delivery method and home testing has been proven more effective than inviting participants to perform the test in a clinical context (Tebb et al, 2004; Cook et al, 2007) because it transmits a sense of control and privacy to patients.

The dependent variable used in this study was the return of the screening kits. Although the pick-up rates could already suggest some difference between the experimental groups, the main measure of the effectiveness of a screening programme is the final completion rates of the tests. Thus, I will only be reporting on the return of the screening kits.

5.3.3 Incentive scheme

Individuals set budgets for spending and allocate expenses in various categories e.g., for food, accommodation, clothing (Thaler, 1999). There is evidence that these categories are not fungible as people usually make strict budget allocations (Hastings and Shapiro, 2013). When the budget for personal luxury (e.g., special dinners, expensive clothing) reaches its maximum, people usually do not transfer funds from regular accounts (e.g., household expenses, transportation). Therefore, we expect the offer of unexpected gift cards to be appealing to students, which usually live with a limited budget.

The incentives offered were HMV gift cards under the forms of a £5 voucher or a £200 lottery. HMV is a retailing company in the area of entertainment with a range of products including audio, books, Blue-ray discs, CDs, computer software and hardware,

DVDs, video games, posters, as well as an increasing range of clothing and fashion items. The £5 voucher value was chosen as the small incentive to correspond to the relatively effortless task of this type of screening. The £200 lottery was selected to be sufficiently engaging for students. Participants were not informed of the likelihood to win the lottery (e.g., how many students would be included in the drawn) which may carry limitations in its comparison with the voucher as there are no comparable expected values. Nevertheless, in real settings involving prize draws e.g., National Lottery, Lotto, people are hardly ever informed of their probability to win the prize. Hence, although the effectiveness of the voucher and the lottery cannot be compared on grounds on their expected value, it compares small certain versus higher uncertain incentives and hold a high external validity because it reflects the reality of public health interventions.

Participants in the voucher groups received the incentive on-site upon return of the screening kit. Students performing screening in the lottery group were enrolled in a prize draw and told the results would be announced the next day. Through random number generation, participants were randomly attributed an ID number in an excel sheet and the winner selected through the random return function. The winner was informed by email and sent the £200 voucher by post.

5.3.4 Study Design

This study used a 2 (framing: gain, loss) x 2 (type of incentive: certain, uncertain) design with a control group (Table 5.1). Halls of residence were randomised to receive one of these four incentive offers (four experimental groups) or no offer of incentive (control group). Copies of the leaflets delivered are presented in Appendix 3. The offer of incentive was framed as following for the 'gain' interventions:

- "If you pick up the screening test and return it, you will gain a £5 HMV voucher" (certain small gain)
- "If you pick up the screening test and return, you will gain the chance to participate in a £200 HMV voucher lottery" (uncertain high gain)

In the 'loss' interventions, students were informed that:

- "If you don't pick up the screening test and/ or don't return it, you will lose a £5 HMV voucher" (loss of a certain small gain)

- "If you don't pick up the screening test and/ or don't return it, you will lose the chance to participate in a £200 HMV voucher lottery" (loss of an uncertain high gain).

		Incentive Frame	
		Gain	**Loss**
Incentive Probability	**Certain**	Receive £5 HMV voucher if returns the test	Loses £5 HMV voucher if doesn't return the test
	Uncertain	Participate in a lottery to win £200 HMV voucher if returns the test	Loses the possibility to participate in a lottery to win £200 HMV voucher if doesn't return the test

Table 5.1 Incentive scheme for the Chlamydia screening trial

The leaflets include an image of the voucher that could be received upon screening performance, in an attempt to elicit feelings of perceived ownership and an endowment effect. Previous research has shown that perceived ownership can be increased by the mere touch with imagery of an object (Peck & Shu, 2009). I present the image of the voucher and its value in the leaflets distributed to students expecting to increase the psychological salience of the offer (Ariely et al, 2005; Yechiam & Hochman, 2013a,b).

5.4 Results

5.4.1 Incentive versus control

Chlamydia kit return was significantly higher when financial incentives were offered – regardless of the type of incentive - **confirming Hypothesis 1**. Those who received an offer of a financial incentive were more likely to return the kit than those who did not receive an incentive offer ($\chi 2=20.040$ df=1 $p<.001$): only 1.5% of the students from control group returned the kits that they had picked up compared to 8.9% of students that were offered incentives.

5.4.2 Voucher versus Lottery

Offering a voucher was more successful at leading to test kit returns than offering an opportunity to take part in a lottery. **This result confirms hypothesis 2**, which predicted the voucher to be more effective than the lottery. There was a significant difference in the proportion of Chlamydia kits returned according to the type of incentive ($\chi2$=75.541 d.f. =1 p<.001), with a higher return of Chlamydia kits when a £5 voucher was offered (22.8%) compared to a £200 lottery (2.8%).

5.4.3 Gain versus loss framing

The effect of framing the incentive offer as a potential gain or loss was confirmed at .1 level of significance. Gain-framed incentives were marginally more effective than loss-framed incentives (10.5% vs. 7.1%; $\chi2$=2.589 df=1 p=.069). **This result does not confirm Hypothesis 3** which predicted that loss framed incentives would be more effective to increase kit return. Although the sample size does not allow a formal interaction test, a frequency analysis of returned kits per type of incentive vs. framing does not suggest an interaction (Figure 5.1). For both types of incentives there was a slightly higher return in the case of gain framed messages but not significant in either case (Voucher ($\chi2$=.128 df=1 p=.425; Lottery ($\chi2$=1.192 df=1 p=.206).

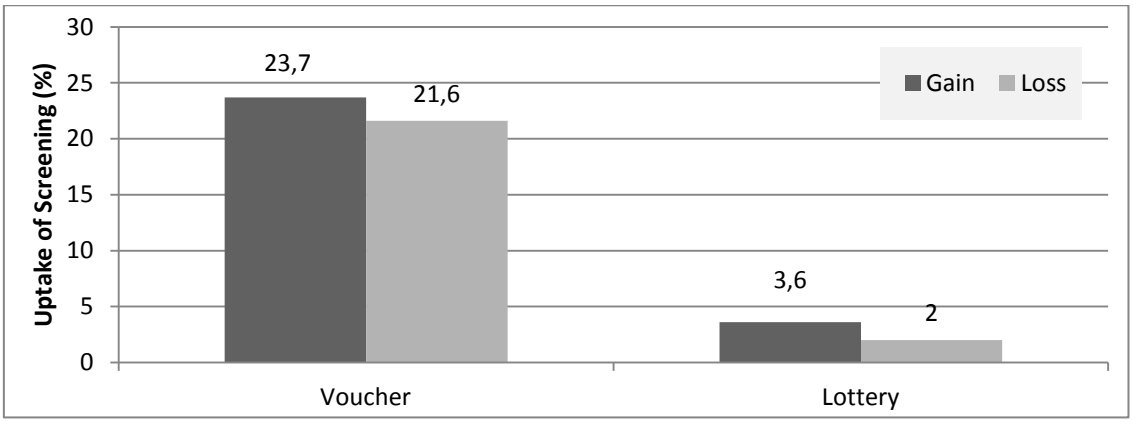

Figure 5.1 Uptake of Chlamydia kits per type of incentive vs. framing

5.4.4 Gender distribution and kit return

Halls had different gender proportions ($\chi2$=84.811 df=3 p<.001) with a higher female proportion in the halls in which incentives were offered. This was controlled for in the regression analysis. Gender makes no statistically significant difference in whether a kit was returned in the control group (male 1.1% vs. female 2% $\chi2$=0.463 p=0.661) but

proportionally more men than women returned screening kits when an incentive was offered (male 17.6% vs. female 8.3% $\chi 2$=10.302 p=0.002).

5.4.5 Logistic Regression Model

I performed a logistic regression model to examine the determinants of Chlamydia screening uptake (Table 5.2). The offer of a financial incentive was a significant predictor (B=2.719 p=.001).

Screening uptake	B	*SE* β	z	P>z	Lower 95% CI	Upper 95% CI
Incentive (*0=no incentive)*	2.719	.795	3.42	0.001	1.159	4.279
Type (*0=voucher; 1=lottery)*	-1.180	.327	-3.61	0.000	-1.822	-.539
Framing (*0=loss; 1=gain)*	.117	.162	0.72	0.471	-.201	.436
Hall	-.103	.205	-0.50	0.616	-.507	.300
Gender (*0=male; 1=female)*	-.264	.151	-1.75	0.080	-.560	.031
Constant	-1.921	.437	-4.39	0.000	-2.778	-1.064

LR chi2(4) =89.11 Prob>chi2=0.0000; Loglikelihood=-197.14929; PseudoR2=0.1843

Table 5.2 Logistic regression analysis of Chlamydia screening kit return

The type of incentive was also a factor influencing the uptake of screening (B=-1.180765 p<.001). The negative sign of the coefficient reflects the higher effectiveness of the voucher compared to the lottery. The impact of the cluster randomisation was controlled by introducing student hall as covariate and this variable did not have a significant effect. Gender was marginally significant (p=.08) exhibiting a tendency for male students (compared to females) being more likely to perform screening upon the offer of a financial incentive.

5.5 Discussion

This study tested the impact of financial incentives to promote Chlamydia screening in 18-24 years old undergraduate students in a naturalistic setting – student halls of residence. The incentive offered was a HMV voucher either in the form of a £5 voucher or a £200 lottery voucher. Incentive messages were framed as either a gain (e.g., *If you pick up the screening test and return it, you will gain a £5 HMV voucher)* or a loss (e.g.,

If you don't pick up the screening test and/ or don't return, you will lose a £5 HMV voucher).

Results showed that the offer of an incentive was effective in increasing the return rate of Chlamydia screening kits (8.9% of students returned their kits versus 1.5% for those with no incentive offer). This finding corroborates hypothesis 1 and past observational studies (Currie et al, 2010; Martin et al. 2012; Zenner et al, 2012).

Results also showed that a £5 voucher was more likely to result in a returned test kit (22.8%) than offering students a £200 lottery (2.8%). This confirms hypothesis 2 and the work of Chacko et al (1987) in the United States, also failing to find any effect of a lottery to promote STI screening. The preference for vouchers over lotteries is consistent with Zenner et al (2012) which reached a similar conclusion using observational data. I propose that, in the case of an activity which requires an immediate effort and discomfort like a STI screening test, a certain reward is more effective.

It could be argued that an uncertain gain of £200 may not be sufficiently motivating for students to perform a STI screening test. However, a comparison with other studies which have offered lotteries to promote health behaviour (e.g., Yokley and Glenwick, 1984; Moran et al, 1996; Rhodes et al, 2003; Volpp et al, 2008) lead me to question this possibility because lotteries as low as £5 have been showed to be effective. Moreover, there could have been an the influenced of an immediacy effect because lottery incentive was offered delayed i.e., the next day and young people who are particularly driven by immediate rewards (O´Brien et al, 2011; Worthy et al, 2011). However, meta-regression results in chapter 4 did not show a significant different impact between immediate versus delayed incentives.

Interestingly, my study does not support other UK experimental study (Low et al, 2007) which found no effect for a £10 voucher to promote Chlamydia screening. This divergence could be due to population specificities and methodological differences: Low et al (2007) send an invitation for screening by post to young people not living in student halls. However, it could also be the case that this difference is explained by incentive size. My meta-regression results in the previous chapter (chapter 4) showed a marginal negative effect for incentives $10+ compared with lower incentives. The £5 voucher incentive offered in this study corresponds to $8 and £10 voucher translates into $16. I will return to this question in the next chapter.

There was a marginal difference between gain versus loss incentive framing but in the opposite direction of initial predictions, with gain framing being slightly more

effective than loss framing (10.5% vs. 7.1% respectively). This result did not support hypothesis 3, a hypothesis based on loss aversion from prospect theory. Our results contradict some studies on smoking cessation (Gine et al, 2010; Romanowich & Lamb, 2013) but, in their case, there was an actual initial endowment and thus, an actual loss. In my study, students could forego a gain but would not suffer from a real loss. The voucher image it may not have been successful in creating a psychological sense of ownership. While some research suggest that mere imagery and touch is enough (Peck & Shu, 2009), others (Morewedge et al, 2009; Reb & Connolly, 2010; Knetsch & Wong, 2009) propose that the endowment effect only occurs in the case of actual physical possession of the object, more than simply by eliciting a psychological ownership. Another possible, simpler, explanation is based on the review by Alk et al (2011) showing that health message framing is more effective at producing changes in attitudes and intentions than actually altering health behaviour.

An alternative justification is that smoking cessation is not directly comparable to STI screening. In fact, one of the fundamental distinctions made in this work in the introductory chapter is between intermittent behaviours (in which STI screening is included) versus habitual behaviours (in which smoking is included). One of our fundamental premises for this distinction was that the utility from the offer of a financial incentive could be different in a context of habitual addictive behaviours that provide an immediate gratification (smoking) compared to behaviour that involve an immediate cost (screening). A sequence of loss-framed incentives may be more effective to tackle habitual addictive behaviours than a single potential loss motivates people to engage in behaviour that already involves perceived costs.

It could be the case that loss-framing is mostly effective when framing outcomes that people want to avoid (which has been the focus of most past research on framing effects) but not when framing potential offers or benefits. In this case, framing an incentive offer as a potential gain may create a positivity effect that makes gain-framing more effective. Incentive offers have been shown to increase positive mood (Meloy et al, 2006) for which gain-framed messages are congruent and not a conflicting or mismatching stimuli like loss-framed messages. A fairly similar effect has been reported in the negotiation literature: negotiation offers framed as gains to the other party lead to better outcomes than loss framed offers (De Dreu et al, 1994). In a certain way, when health providers offer financial incentives to promote health behaviour, there

is an implicit negotiation of the terms by which patients accept to comply with health care.

The work by Hanrick et al (2007) raises another argument. They showed that gains loom larger than losses for small amounts of money up to €10. Accordingly, a gain-framed £5 incentive should be more appealing than a loss-framed £5 is upsetting. However, this result should not occur for the £200 lottery unless people do no code the lottery value by its overall payoff but estimate its expectd value.

Young men were particularly motivated by the offer of an incentive: there was a significant gender difference in kit return when the £5 voucher was offered (male 17.6% vs. female 8.3%). This evidence contradicts Zenner and co-workers (2012) which found the opposite result using observational data. It is remains unclear if my results are specific to the incentive used (men may prefer HMV vouchers to other type of incentive offered in previous studies) or reflect a more general tendency. My data is consistent with previous experimental studies offering incentives in the context of STI screening (Gift et al, 2004) and research showing that men have a greater sensitivity to reward than women (Segal and Podoshen, 2005; Silverman, 2003). Although men tend to have higher risk-taking levels than women (Weaver et al, 2012) suggesting that the lottery could have a greater appeal for males, no significant difference was found between the sexes for this particular incentive.

5.5.1 Policy Implications

My results combined with a few other previous studies (Chacko et a, 1987; Zenner et al, 2012) indicate that certain incentives, even if small in size, are a better strategy than prize draws to promote Chlamydia screening in young people. And given that STI screening mostly targets young people, the incentive offer should be compatible with the age range e.g., entertainment gift-cards, clothing vouchers. Research about the public acceptability for incentive use (Promberger et al, 2011) also suggests vouchers as acceptable offers to a young student population.

However, an overview of all studies that have offered financial incentives to promote Chlamydia screening (Kissinger et al, 2000; Malotte et al, 2004; Low et al, 2007; Currie et al, 2010, 2012) shows that roughly only about half the interventions were successful, strongly suggesting that are not a universal remedy in this context.

At the population level, the differences found in a pilot study may represent a considerable increase in screening coverage but pose, nevertheless, the questions of

sustainability and cost-effectiveness. On one hand, the macro-level implications of increasing screening rates with such an intervention should be analysed. My results show an absolute risk reduction (ARR) of 7.4% by offering financial incentives, corresponding to 219 young people needed to be incentivised to avert one future case of Chlamydia – assuming a 6.2% prevalence rate from Roberts et al (2007). For the lottery intervention, ARR is 1.3% and the number needed to incentivise is 1271. For the voucher intervention, the ARR is 21% and the number need to incentivise is 76. This suggests that a significantly lower number of young people would need to be invited if offered a voucher compared to a lottery or no incentive. And the cost per returned test according to Robinson et al (2007) is estimated to be £18.55 in the voucher group whereas under the lottery prize, the cost per returned test is £27.85. The cost per returned test using lotteries can be reduced by increasing the number of people entering the prize draw. If the same £200 lottery was offered to 2000 young people, the cost per returned test would have been £17.12.

5.5.2 Limitations and future research

The main limitation of this study is the clustered nature of the data which increases the uncertainty about the independence of observations. Nevertheless, I provided effect size calculations and controlled for the impact of hall variation in the regression analysis. A higher number of clusters (in our case, student halls) could have minimised the impact of cluster randomisation in the data. Future studies should address this sampling limitation and design more robust interventions with individual-level randomisation.

With respect to the incentives offered, it is possible that a cash incentive could have been more effective (Mallote et al, 2004). There were restrictions from the ethics and academic committees which limited incentives to vouchers and of reduced amount: initially I proposed a £2000 lottery voucher to approximate the expected value from a £5 voucher which was rejected. HMV vouchers were chosen as an incentive potentially attractive to most students but we cannot exclude the possibility that other gift cards could be more appealing. Future studies should examine more thoroughly the moderating effect of the type of incentive. Even if the evidence to date suggests that small certain incentives are more adequate than prize draws to promote Chlamydia screening, it is still necessary to establish which specific type of incentive (clothing gift-cards, food vouchers, electronic gadgets etc) is more successful.

A potential confounding aspect may have been present in the framing of incentive offers. I presented the image of the voucher in the leaflet in an attempt to create an endowment effect or psychological ownership towards the voucher (Peck & Shu, 2009) and thus increase loss aversion (Ariely et al, 2005). However, the voucher image was present in both the gain and loss-framed messages. The manipulation may have successfully at creating a loss aversion effect in both conditions or, if the manipulation was unsuccessful, no true loss aversion condition was created. Future research should attempt to manipulate loss aversion in a more tangible way whenever possible e.g., by giving incentives to subjects in advance but that could only redeemable upon performing screening.

The overall low kit return (8.9%) even with an incentive could be explained by our procedure: inviting students to voluntarily perform Chlamydia screening, most of which had no prior information about the disease, may be an unproductive strategy. Nevertheless, this procedure is consistent with the common outreach approach from health organisations in the UK. Every year, students living in University halls are offered free Chlamydia screening in a similar way. Our study suggests this approach should be reconsidered given the very low kit return in the control group (1.5%) which can be taken as a proxy of the success that outreach strategies have in student halls without any offer of financial incentives. But, within the existent outreach approaches, this direct contact with student in halls of residence may nevertheless be a good strategy. A direct approach may facilitate engagement with the screening process.

Administrative services from student halls did not have extensive information about the students living in their facilities. They did not have information about student income levels (or the socioeconomic status of their families) and no record of past Chlamydia screening. This information could not be retrieved at Universities or Health Centres given the variety of academic affiliations of the students. Thus, research question 3 about past (screening) behavior and income level could not be examined in this study. Furthermore, it was not feasible to collect this missing information or any other supplementary data on individual differences directly with the students due to a risk for self-selection bias. Students could have been contacted by email before or after the intervention to complete an online survey measuring potentially important psychological constructs as risk attitudes or time preferences; however, only a particular group of students (e.g., those who were planning to take the test) could have agreed to answer the survey. This would have eliminated the purpose of randomization and would

have transformed the study, at best, into a quasi-experiment, assuming that there would be enough students per experimental condition answering the survey.

Future research should also address the long-term unknown effects of offering incentives to change sexual health behaviours, particularly in young people. The offer of incentives for young people to engage in health behaviour may have potentially negative effects in the way they shape their future relationship with health services, by instigate an expectation of conditional rewards. This remains to be answered.

Chapter 6

Segregating Gains in Colorectal Cancer Screening

In this randomised controlled trial, I test the impact of segregating incentives (separating a single payoff in two rewards) to increase the uptake of colorectal cancer screening. Incentivising colorectal cancer screening provides a naturalistic setting to test how people prefer the distribution of gains (incentives) in a temporal sequence of events. Screening was framed as a multistep process and I test the effect of one €10 incentive (offered upon completion of screening) versus two €5 incentives (offered at the beginning and the end of screening). This field experiment makes a pioneering contribution to the literature by providing the first experimental test of preference for sequences of outcomes – and in a critical public health setting. Eligible participants were patients aged 50-74 (N=2478) with no screening history within the past two years in a Portuguese public health centre. Patients were randomly allocated to receive an offer of €10, two offers of €5 or no incentive (control group). Compared to the control group (53%), the uptake of screening was 41% for participants offered one incentive (B=-.220 p=.02) and 61% for patients offered two incentives (B=.150 p=.04). These results suggest a preference for segregated gains in sequences of temporally distant outcomes. Furthermore, this evidence suggests a motivational crowding-out effect of a single offer of €10 that is avoided when smaller incentive offers (€5) are given. Theoretical contributions and policy implications are discussed.

6.1 Colorectal cancer screening as a sequence of events

In the last empirical chapter of my thesis (this chapter 6), I test the impact of segregating incentives (separating a single payoff in two incentives) to increase the uptake of colorectal cancer screening. This study makes a ground-breaking contribution to the literature as the first study testing preferences for sequences of outcomes in the field. Incentivising colorectal cancer screening provides a real setting to test how people prefer the distribution of gains (incentives) in a temporal sequence of events.

Unlike most other cancer screening procedures, in which patients go to health care facilities to perform screening e.g., mammography, Pap smear or ultrasound, in the case of colorectal cancer patients are responsible for performing the test at home in a more lengthy process. The most common procedure is a faecal occult blood test (FOBT) characterised by patients (i) picking up a screening kit or receiving it by post, (ii) collecting stool samples at home over several days and (iii) return the results to the lab. The complexity and duration of this screening process depends on national guidelines but despite some variability in the process across countries, there are usual several stages which enable us to frame this procedure as a sequence of events and support the generalisation of our results.

Therefore, in this study, screening was explicitly framed as a 3-step sequence process and I test the effect of offering ***one €10 incentive*** (upon completion of screening) versus ***two segregated €5 incentives*** (offered at the beginning and the end of screening). According to Varey and Kanheman (1992), a compelling heuristic for the evaluation of extended episodes is to focus on a few selected points as a proxy for the whole event and a focus on the beginning and end experiences are the common moments chosen by people – supporting my choice for the segregation of the single €10 incentive into an initial €5 offer upon engagement in screening and a final €5 offer upon the conclusion of screening.

This study is original in the literature for its combination of methodological robustness and theoretical contributions. On one hand, I provide field data from a large randomised controlled trial (N=2478) about the impact of patient incentives to promote colorectal cancer screening – the first study ever examining the offer of tangible patient financial incentives to tackle this critical public health problem. In a review of the literature, Stone and colleagues (2002) showed that the large majority of interventions to promote colorectal cancer screening have been (i) educational, with the dissemination of information about the disease and benefits from screening and (ii) through reminders,

prompting patients to undergo screening. Of both interventions, only the latter was shown to have a significant impact. In addition to reminders, Stone and colleagues identified financial incentives as the only other patient-centred effective intervention. However, they have seldom been used (Holden et al, 2010), strictly in the United States and of a *different nature of the incentives examined in my work*.

There are only a couple of studies offering incentives to promote colorectal cancer screening and both use incentives under the format of prepaid postage for the return of screening tests by post. Miller and Wong (1993) reported a 61% return rate for the control group (no prepaid postage) and 74% for the incentive group (prepaid postage) (p=.02). Freedman and Mitchell (1994) reported a 57% uptake rate for the control group and 71% for the incentive group but these differences were not significant. Nevertheless, incentives in the form of prepaid postage (which are cost reduction or barrier elimination incentives) are not directly comparable to the tangible positive reinforcers that I have been examining in this thesis. This argument is based on the distinctions drawn between positive and negative reinforcement related to the behaviour modification literature (Chapter 2 page 29-30). Positive reinforcement is implemented by providing rewards that increase pleasure whereas negative reinforcement decreases cost .From an economic perspective, both are positive incentives in the sense that both increase utility. However, from a behaviour modification perspective, positive reinforcement (offering a voucher or money) is psychologically different and expected to be more effective than negative reinforcement (reducing or eliminating costs) (Martin & Pear, 2007).

On the other hand, I provide the first behavioural evidence about preferences for sequences of outcomes. The limited existing evidence about preferences for sequences of outcomes is based on a few papers from surveys and lab studies (Thaler & Johnson, 1990; Linville & Fischer, 1991; Loewenstein & Prelec, 1991, 1993; Morewedge et al, 2007) in which the dependent variable is a stated preference measure i.e., self-reported choice between different hypothetical options. There is no behavioural evidence from the lab or the field. To the best of my knowledge, this study is the first experimental test of preferences for sequences of events, providing field evidence of the impact of segregation of gains to change (health) behaviour. Furthermore, unlike the previous studies on this subject, my design is not within-subjects i.e., participants usually chose between integrating or segregating gains. This study has a between-subjects research

design, implying that the main effects of integration versus segregation will be tested independently.

In addition to being a field test of preference for segregated gains, it also offers indirect evidence about the impact of incentive size. Meta-regression in chapter 4 suggested a negative effect of incentive size, with incentives $5 and under being marginally more effective than incentives $10 and above. These results are in line with other studies from behavioural economics showing a negative or nonmonotonic relationship between incentive size and behaviour (Gneezy & Rustichini, 2000; Ariely et al, 2009; Pokorny, 2008). Offering the same overall payoff (€10) divided in smaller units (€5x2) tests if the 'optimal' incentive offer is around $5(€5) because even though patients in the 'two incentive' group receive €5 each time, they know the overall payoff will be €10.

Meta-analysis and meta-regression in Chapter 4 also identified cancer screening as one of the health contexts resistant to the offer of financial incentives but for which very few experimental studies were available. In the qualitative review, from the 18 papers on cancer screening, 61% were about breast cancer screening, 22% on cervical cancer screening and 17% on colorectal cancer screening (but no paper on colorectal cancer was included in the meta-analysis because incentive size was not disclosed in any study). Colorectal cancer is the second most frequent form cancer in Europe and first in many countries for ages 45-74 (Ferlay et al, 2007). Colorectal cancer is one of the forms of cancer (along with breast and cervical cancer) where consensus has gathered about the effectiveness of early screening, which has been shown to significantly reduce mortality and incidence rates (Hewitson et al, 2007; Diaz & Slomka, 2012).

However, colorectal cancer has significantly lower screening rates compared to breast and cervical cancer screening. Data from population-level screening programmes in Europe show that breast and cervical cancer screening reach on average of 80%-85% coverage but colorectal cancer typically has a lower uptake of around 50% or less (Breen et al, 2001; Moss et al, 2012; Szczepura et al, 2008; Smith et al, 2012). Screening related barriers – fear of the screening procedure and discomfort dealing with stools - are strong determinants of poor screening rates (Kininiemi et al, 2011; Jones et al, 2010ab). Jonas and colleagues (2010) estimated the mean willingness to pay to avoid performing colorectal cancer screening (colonoscopies) as $263. The faecal occult blood test (FOBT) I will be using here is not painful or cause physical discomfort like a

colonoscopy so I assume the WTP to avoid performing the FOBT would be much less. This implies that the disutility of performing FOBT should be lower and a financial incentive may more easily provide a compensatory gain. Nevertheless, can a relatively small incentive of €10 overcome these strong negative barriers? My hypothesis is that it can (hypothesis 1 below), assuming that small segregated incentives accompanying the screening process will provide a hedonic gain above the objective total payoff of the incentive.

6.2 Preferences for sequences of outcomes

Whereas the literature provide clear hypotheses about temporal preferences for a single event, it is less clear about the evaluation of joint outcomes (Loewenstein & Prelec, 1993). In a choice between one benefit now versus later, people typically exhibit preferences for immediate rewards (Abdellaoui et al, 2010). There is a consistent tendency for positive time preferences (Read et al, 2002): individuals are impatient and crave immediate consumption, preferring gains sooner rather than later. And this effect holds either assuming exponential or hyperbolic time discounting (Frederick et al, 2002). However, most studies examining time preferences examine how people evaluate simple prospects consisting of one outcome obtained at a certain point in time (Loewenstein & Prelec, 1993). Translating these results into the evaluation of a set of outcomes would suggest that people should invariably want to start with the best outcome and leave the worst outcome to last e.g., declining rather than increasing standard of living, deteriorating rather than improving health states.

But if choices are explicitly framed as a sequence of events, people seem to exhibit a different pattern of preferences. A temporal sequence is a series of outcomes spaced over a defined period of time. In the case of a sequence of gains, studies show a negative time preference for gains (Loewenstein & Prelec, 1991), suggesting a preference for 'happy endings' or improving outcomes. People report preferring increasing consumption (Senik, 2008) and rising wage profiles above flat or decline over time (holding total value constant) (Loewenstein & Sicherman, 1991; Duffy & Smith, 2010). Ross and Simonson (1991) asked participants (n=202) if they would prefer to first lose $15 and then win $85 or the reversed order: 73% of participants preferred to lose money first. When deciding between alternative scheduling of two events, one to be spent with an irritating person and the other with a pleasant person,

90% of people chose the irritating person first and the pleasant a week after (Loewenstein & Prelec, 1993).

The literature in this area proposes a number of possible reasons for this preference for improving outcomes. Loewenstein (1987) proposed a savouring and dread hypothesis. Savouring and dread contribute to preferences for improvement because, for gains, improving sequences allow decision makers to savour the best outcome until the end of the sequence. Anticipatory utility is one of the reasons for saving the best for last (Caplin & Leahy, 2001). With losses, getting undesirable outcomes over quickly eliminates dread.

Similarly, a recency effect is also consistent with overweighting the last event in forming an overall evaluation of an experience (Read & Powell, 2002). An experience that ends on a positive note tends to be evaluated more positively than an experience where the positive note occurred earlier.

Loss aversion (Kahneman & Tversky, 1979) also has some similarities with this explanation. Inherent to loss aversion is the idea that people give more weight to outcomes below a reference point (losses) than to outcomes above a reference point (gains). It is often assumed that the reference point is influenced by the last outcome. Thus, improving sequences could be represented as a series of gains from a series of shifting reference points.

Another possible explanation is based on the concepts of adaptation and contrast. Tversky and Griffin (1990) examined the impact of a salient hedonic event, positive or negative, on the evaluation of a subsequent event. They proposed and demonstrated that an earlier event has a dual contribution to the utility associated with a later event: an endowment effect and a contrast effect. The endowment effect represents the direct contribution to one's happiness or satisfaction. The contrast effect represents the indirect contribution of an event on the evaluation of subsequent events. A positive (negative) outcome makes people happy (unhappy) but it also makes future events appear positive (negative) events appear less positive (negative).

Preferences for one event (e.g., now versus later; near future versus far future) and two events have received the most attention in the literature (Linville & Fischer, 1991; Jarnebrandt et al, 2009; Ross & Simonson, 1991; Thaler & Johnson, 1990; Milkman et al, 2012). However, preferences for three outcomes being evaluated jointly are not as clear (Loewenstein and Prelec, 1993). In addition to the desire for improvement over time, individuals also exhibit sensitivity for a global evaluation of

events, like a gestalt perspective related to how evenly the good and bad moments are arranged over a total time interval. Loewenstein (1987) analysed preferences for mixed outcomes in the case of three meal choices. In the first case, he compared preferences for the distribution of two regular home dinners and French restaurant dinner over three weekends. Results showed a clear preference (84% of participants) for dinning in the French restaurant in-between to the two home meals. In the second case, the three possibilities were eating at home, French restaurant and Lobster dinner (in increasing order of desirability) over three weekends. Results showed a slight preference (57%) for dinning out in the first and last weekend (and eating at home in-between the two restaurant dinners) than leaving the restaurant dinners for last – which would be more consistent with a preference for improving outcomes.

The preference for spreading seems to be anchored in the fact that segregated outcomes cover the time interval in the sequence more evenly. Models of habit formation and loss aversion do not fully capture the global properties that people find attractive in spreading outcomes. Loewenstein and Prelec (1993) developed a theoretical model that attempts to account for both preferences for improvement and uniformity. The model defines improvement over time as the sum of deviations from the cumulative sequence that would be obtained by spreading total utility evenly over time. Evenness of spread is represented by the sum of the absolute value of these deviations. These authors propose that "*there is a general strong preference for improvement moderated by a penalty for deviation from global uniformness and a small premium for sequences that start (*and finish*) well*" (p.351).

Thaler and Johnson (1990) put forward that studies evaluating preferences for joint outcomes show evidence indicative of a *hedonic editing hypothesis* (1990), through which people edit the choices in a way that would make the prospects appear most pleasant. This research area may have direct implications for the offer of incentives in a multistage health process. If the health compliance process is simple e.g., one-shot flu vaccine, patients should be informed that the incentive will be given at the end: vaccine (cost) followed by the incentive (gain), benefiting from people's preference for improving outcomes. However, if compliance is more complex and lengthy – as is the case for colorectal cancer screening - the overall available incentive amount should be distributed in such a way that it accompanies patients to the completion of the screening pathway. Therefore, I predict that:

Hypothesis 1: Segregated incentives are more effective in increasing the uptake of screening than a single incentive of the same amount

One of the main limitations of this hypothesis lies in the possibility that time preferences are a confounding factor. An immediate gratification effect and not a preference for segregated gains could also support this hypothesis 1. Potential differences between incentives groups could be attributed to a positive time preferences (€5 now versus €10 later) and not a gain-savouring hypothesis (Linville & Fischer, 1991) because patients in the 'two incentives' group receive an incentive earlier in the process. To control for the impact of immediate gratification, this study should include a third experimental group, which would receive a single €10 incentive at step 1 and nothing in the remaining steps. But such a group would pose a couple of problems. Firstly, a theoretical problem: there is evidence to support that, in a sequence of events, people prefer to start with costs and finish with gains (Ross & Simonson, 1991). The preference for immediate rewards only seems to hold for single outcome events. Secondly, a practical problem: if people receive an incentive at the beginning of the screening process, there are fewer guarantees that they will complete the test. Although several studies have shown that a noncontingent incentive given in advance does not necessarily lead to drop-outs (e.g., Dolan & Rudisill, forthcoming), it introduces a greater uncertainty about the future behaviour of patients.

A study from Thaler and Johnson (1990) suggests that the preference for segregated gains dominates the preference for immediate gratification in the case of multiple events. The authors analysed the evaluation of separate gains that included a temporal order. They proposed that the process of segregating gains is facilitated by having events occur on different days. These authors presented participants (N=65) with the following scenario. There is a pair of events: (i) win a $25 lottery and (ii) win a $50 lottery and these events happen on the same day for Mr. A or two weeks apart for Mr. B. Who is happier? 63% of participants answer Mr. B. Participants seemed to prefer to spread out the arrival of pleasant events over receiving the total amount immediately, presumably because segregated gains have an overall higher hedonic value.

6.3 Segregation of gains and crowding-out effects

As I have extensively discussed in previous chapters, behavioural research has exposed situations in which incentives may backfire, mostly identified in contexts where people

want to behave altruistically, are engaged in enjoyable activities or want to fulfil their duty as citizens (Deci et al. 1999; Bowles et al, 2008; Mellström & Johannesson, 2008). The meta-analysis in chapter 4 showed an overall positive of incentives to increase compliance and thus these results do not suggest a crowding-out effect of incentives - interpreted as a decreased likelihood to comply when patients are incentivised. However, meta-regression showed no effect of incentives specifically to promote cancer screening, although no study about colorectal cancer screening was included in the analysis.

Colorectal cancer screening is a functional behaviour as many other health behaviours i.e., a means towards an end (better health, longer life expectancy) and not pleasurable in itself. Therefore, it apparently falls outside the boundary conditions of intrinsic motivation. However, some people may consider cancer screening a kind of citizenship behaviour, particularly if considered a request by their personal GP. Colorectal cancer screening is performed by people aged 50+ and older people tend to have a closer and trusting relationship with their doctors compared to younger people (Wrede-Sach et al, 2013). The introduction of financial incentives may undermine confidence in this relationship by introducing a commercial element (Baron & Spranca, 1997). If patients consider an invitation to perform screening as a type of citizenship behaviour, particularly when requested by their GP with whom they may have established a relational or psychological contract, crowding-out effects may be expected according to the economics literature (Frey, 1997; Frey & Jegen, 2001).

There is a possibility that segregation of gains may actually prevent motivational crowding-out by keeping incentive size psychologically smaller. Results from my meta-regression in chapter 4 suggested a negative effect of incentive size, with incentives <=$5 being marginally more effective than incentives $10 and above. These results are in line with other studies from behavioural economics showing a negative or nonmonotonic relationship between incentive size and behaviour (Gneezy & Rustichini, 2000; Ariely et al, 2009; Pokorny, 2008). Offering the same overall payoff (€10) divided in smaller units (€5x2) may avoid a crowding-out effect, if the 'psychologically optimal' incentive offer is around $5(€5). This is not a binary comparison of the valuation of rewards with different magnitudes (e.g., Vlaev et al, 2011) but a between-subjects test of the independent framing effects of segregated versus integrated gains. The only additional piece of evidence shedding light on the role of incentive size in colorectal cancer screening also suggests a negative effect. With a Norwegian sample

(n=627), an estimation model by Aas (2009) showed that the offer of financial compensation for screening would lead to an uptake rate of 47% for €25 but 39% for €125. According to these results, an incentive of €125 (5 times the €25 incentive) would lead to a decrease in screening by 8%. My study was developed in Portugal in which the incentives used by Aas (2009) adjusted to the 2013 cost of living index[5] would correspond respectively to €6.70 (the €25 incentive) and €33.30 (the €125 incentive).

Although the reasons underlying these intricate effects of incentive size are not yet clear, based on this previous evidence I hypothesise that:

Hypothesis 2: The two incentive structure will have a positive impact on screening uptake while the single incentive will result in lower uptake (compared to no incentive)

Thus, in summary, the objectives of this study are two-fold. I aim to test the impact of financial incentives to increase the uptake of colorectal cancer screening by comparing:

1) The effect of an offer of a financial incentive with no incentive;
2) The effect of a single versus a double financial incentive of the same amount.

6.4 Method

6.4.1 Eligible sample

The study was developed in a public health centre in Lisbon, Portugal. Eligible participants were patients aged 50-74 years old who had not performed colorectal cancer screening within the last two years (N=2478). This individual-level sample was composed by 1824 families registered at the health centre: 1190 single individuals; 613 families with two members and 21 families with three members. Randomisation was done at family-level to avoid that members of the same family would receive different incentive offers. The 1824 families were allocated to different treatments by random number generation. Regardless of the family-level of randomisation, each participant received an individual letter and, as such, data analysis was performed at the individual level of analysis.

[5] http://www.numbeo.com/cost-of-living/rankings_by_country.jsp

6.4.2 Procedure

Although Portugal does not have an organised population-level cancer screening programme, colorectal cancer screening is free for people 50-74 years old, if requested by their GPs. The common test for colorectal cancer screening is the Faecal Occult Blood Test (FOBT), characterised by the analysis of microscopic blood in stools. To allow for accurate estimates, six stool samples need to be collected in three different days (two samples per day) and this procedure is performed directly by patients. Contrary to the UK, the FOBT is not currently implemented as a population-level screening method in Portugal. There is no systematic and organised invitation to the target population aged 50-74 year; each individual patient and personal GP decide about the need to perform the test. In Portugal, colorectal cancer screening is typically a multi-stage process:

i) Patients have to obtain a medical credential from their GP, which will allow them to perform free screening in a certified lab;
ii) Patients have to pick up a test kit from the lab, usually including 6 stool collection tubes and an informative leaflet;
iii) Patients do the test at home during 3 consecutive days (2 collections per day);
iv) When completed, patients return the test to the lab;
v) After 5-7 working days, results are usually ready and patients can pick up the results in hand and deliver them to their GP.

For the purpose of this study*, this standard procedure was condensed and framed into three discrete steps*. Patients were invited by letter to perform colorectal cancer screening and asked to:

Step 1: Pick up both the credential and stool test kit in the health centre;
Step 2: Perform the test at home and return it to a referenced lab;
Step 3: Pick up their results in the lab and drop them in the health centre.

Steps 1 and 2 are the most important stages in this process. Step 1 enrols people in the process and Step 2 is the actual performance of the test. Many studies evaluate the screening uptake by Step 1 but without Step 2, in which there is the actual performance of the screening test, Step 1 is not a valid measure of screening rates and a potential

waste of resources. However, Steps 1 and 3 are the moments when patients enter in contact with the health centre and, therefore, the two steps selected to be incentivised. Furthermore, by incentivising Step 3, it was possible to closely monitor the final rate of completion of screening because in the Portuguese Health System, patients return their test results in hand.

6.4.3 Incentive scheme

This study is a 3-way randomised controlled trial: (1) a control group (N=868); (2) a group offered a single €10 incentive (N=805) and (3) a group offered two €5 incentives (N=805). The invitation letters framed colorectal cancer screening as a three-step process spread over time. Although the perceived costs of compliance may be experienced in different degrees by patients, I nevertheless consider that, in the short-term, complying with screening can be described as a cost to individuals (Koszegi, 2003). And I also assume that the incentive offered compensates the cost of screening, providing a net gain to patients (Table 6.1).

	Step 1	**Step 2**	**Step 3**
	Engagement	**Performance**	**Return**
Control	Cost	Cost	Cost
One incentive	Cost	Cost	**Gain**
Two incentives	**Gain**	Cost	**Gain**

Table 6.1 Spread of gains (incentive delivery) and costs (screening process)

For patients offered a single €10 incentive at the end of the screening process, there is a sequence of costs ending with a gain. This sequence is in agreement with a preference for improving outcomes, ending with a large gain. If step 1 and step 2 are accounted mentally by participants as a single 'bundle' of cost, this could be considered a two-outcome sequence and we should expected a preference for improving outcomes. But, to test segregation of gains, I explicitly framed screening as a three-outcome sequence. The 'two incentive' group is expected to be the most effective intervention because it benefits from a segregation of gains plus a spread of gains that covers more evenly the screening procedure.

6.4.4 Time schedule and implementation

The study was approved in October 2012 by the health centre coordinator and the local health authorities. At a later stage, the Ethics Committee of the Ministry of Health also had to approve the study. The study lasted five months from February to June 2013.

A private lab was selected to handle the FOBT. They offered to provide the stool collection tubes (six per patient). Furthermore, the Ethics Committee considered mandatory that the closest hospital to the health centre assumed the responsibility for the follow-up of patients with positive screening results (for colonoscopies) as fast as possible. After a period of negotiations, the hospital committed to a 3 (min) to 6 (max) months to respond to positive results. There is no data about positivity rates available yet.

6.5 Results

6.5.1 Sample characteristics

Incentive groups have a slightly higher proportion of females: 47% in the control group, 54% in the 'one incentive' group and 50% in the 'two incentive' group (X^2=8.525 p=.01). The age differences between groups are statistically different (F=4.087 p=.02) but minimal. The average age in the control was 59.4(SD=7.3), 60(SD=7.2) in one incentive and 60.4(SD=6.7) in two incentives. Since the random assignment did not result in perfectly balanced groups, these differences were controlled for in the regression models below.

It was not possible to access further socio-demographic characteristics or patients' health records, which are not stored locally in each health centre but at a centralised national level. This data is not organised in the national health system in a way to be easily retrieved per health centre but only through individual patient names i.e., on a one-by-one patient basis. National health records could provide information about past compliance with screening (which is a critical point and directly related to my research question 3) but it would still not have been possible to retrieve information about income (also related to research question 3) which is a type of data not included in the patient registration form.

6.5.2 Step 1: Engaging in screening

Results for Step 1 are shown in Figure 6.1: 55.7% of patients complied in the control group, 44,4% of patients in the 'one incentive' group and 62.6% of patients in the 'two incentive' group.

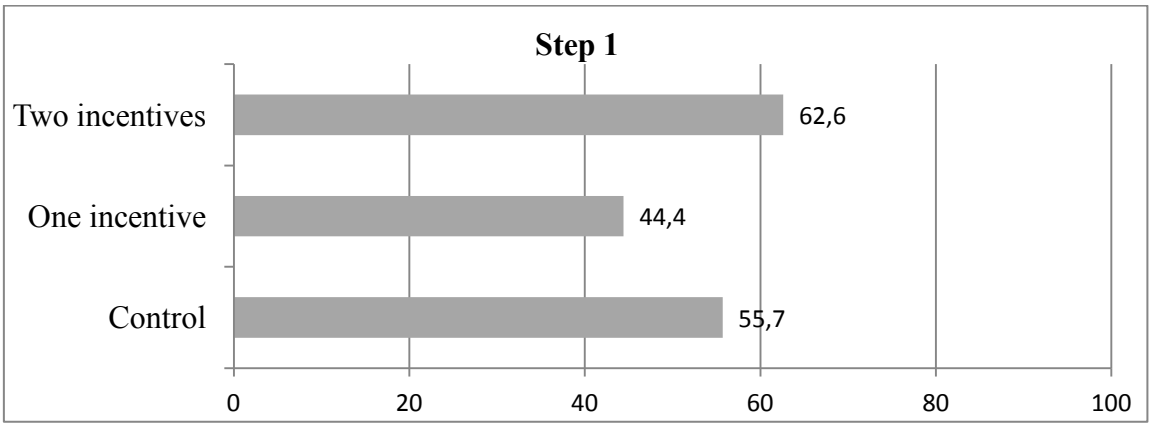

Figure 6.1 Screening rates for step 1 of colorectal cancer screening

The differences between the three groups are significant (X^2=26.390 p=.000). However, taking both incentive groups together, there is no difference to the control group (53.5% versus 55.7% X^2=.266 p=.316). A binary logistic regression analysis (Table 6.2) showed that age had a small (B=.016) but significant impact (P=.007) in the uptake of screening in Step 1. The sex of the participant was not significant. The uptake of 'one incentive' group was significantly lower than the control group (B=-.350 p=.001). The group offered two incentives had a higher uptake (B=.180), at .1 level of significance (p=.07). The coefficients for the treatment effects are significantly different (F=9399.55 p<.001).

	B	**SE**	**Wald**	**df**	**Sig.**	**Exp(B)**
Sex (0=male)	-,001	,084	,000	1	,994	,999
Age	,016	,006	7,251	1	,007	1,016
One incentive (1=incentive; 0=otherwise)	**-,350**	,105	11,153	1	,001	,705
Two incentives(1=incentive; 0=otherwise)	**,180**	,101	3,189	1	,074	1,197
Constant	-1,481	,383	14,924	1	,000	,228

-2 Log likelihood=3208,966; Cox & Snell R Square=,014; Nagelkerke R Square=,019

Table 6.2 Logistic regression analysis for Step 1 of colorectal cancer screening

6.5.3 Step 3: Completing screening

From the participants that picked up the screening kit in Step 1, 94% of the individuals in the control group completed the screening (=return their test results), compared to 90% in the 'one incentive' group and 98% in the 'two incentive' group. These attrition rates correspond to a final completion of 52.8% in the control group, 41.4% in the 'one incentive' group and 61.1% in the 'two incentive' group (Figure 6.2). These differences between the groups are also significant (X^2=8.525 p=.01). The differences found in the uptake of screening at step 1 were maintained for the completion rates at step 3.

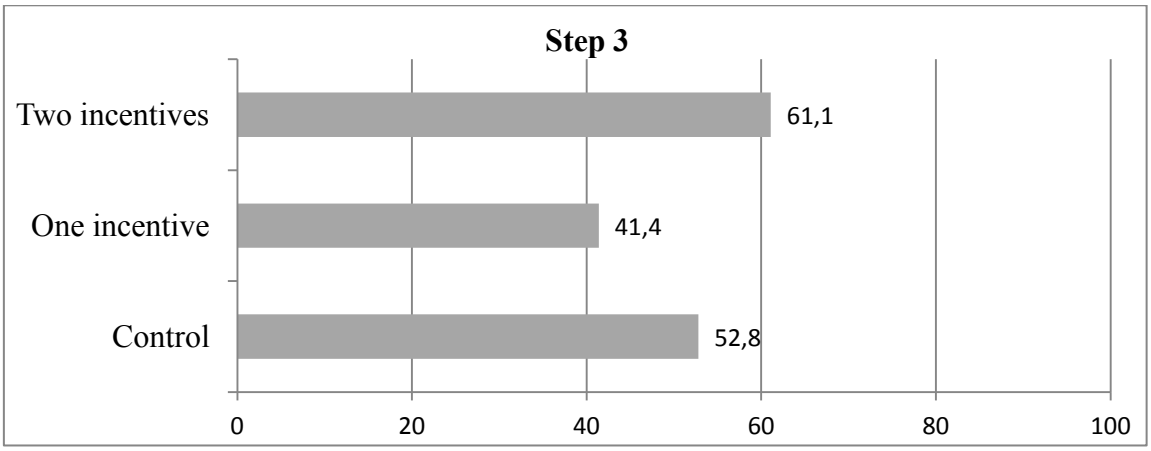

Figure 6.2 Screening rates for step 3 of colorectal cancer screening

The regression model for step 3 is presented in Table 6.3 below. Participants in the 'one incentive' group finished the screening process significantly less often than people in the control group (B=-.220 p=.02). Patients offered the two incentives were more likely to have completed screening compared to the control group (B=.150 p=.04). The coefficients for the treatment effects are also significantly different (F=7359.44 p<.001). There was no significant impact of age or gender in the completion rates.

These results support both hypotheses. Both at step 1 (uptake of screening) and step 3 (completion of screening), the offer of two incentives increased screening rates compared to a single incentive of the same amount, **confirming hypothesis** 1. Furthermore, the offer of the single €10 incentive caused an adverse effect and reduced screening rates significantly below the control group. This effect did not occur with two segregated €5 incentives, **supporting hypothesis 2**.

	B	SE	Wald	df	Sig.	Exp(B)
Sex (0=male)	,005	,082	,000	1	,953	,985
Age	,006	,003	6,241	1	,231	,916
One incentive (1=incentive; 0=otherwise)	**-,220**	,305	10,154	1	,002	,805
Two incentives(1=incentive; 0=otherwise)	**,150**	,201	3,195	1	,004	1,699
Constant	-1,280	,353	12,922	1	,000	,520

-2 Log likelihood=2908,963; Cox & Snell R Square=,020; Nagelkerke R Square=,022

Table 6.3 Logistic regression analysis for Step 3 of colorectal cancer screening

6.6 Discussion

To the best of our knowledge, this randomised controlled trial is the first study ever testing preferences for sequences of outcomes in the field. And it did so addressing an important public health problem – low colorectal screening rates. Hitherto, there were very few studies testing behavioural interventions to promote colorectal cancer screening (Stone et al, 2002; Holden et al, 2010) and only two randomised controlled trials offering incentives (Miller & Wong, 1993; Freedman & Mitchell, 1994) – both using cost reduction incentives (prepaid postage) and thus not directly relevant to my analysis of tangible conditional incentives.

In this large field study, patients were randomly allocated to receive an offer of €10, two offers of €5 or no incentive (control group) to perform colorectal cancer screening. Compared to no offer of a financial incentive (56%), one incentive of €10 was less effective (44%) but the offer of two incentives of €5 was significantly more effective (63%). Hypothesis 1 proposing that two smaller incentives outperform a single larger incentive was confirmed, corroborating previous lab studies (Thaler & Jonhson, 1990; Linville & Fischer, 1991; Loewenstein & Prelec, 1991, 1993; Morewedge et al, 2007). However, unlike these previous studies, evaluating within-subjects preferences for integrated or segregated gains, my work establishes the independent effect of segregation of gains (over integrated gains) using a between-subjects design in a field study.

Research on anticipatory utility (Caplin & Leahy, 2001) and a preference for segregating gains in a sequence of events (Thaler, 1985, 2008) are both in line with the result of two incentives (at the beginning and end of a sequence) being comparatively more effective than one incentive (given only at the end of a extended process). Although it was expected that segregated incentives would be more effective than a single incentive to encourage screening uptake, the crucial question is related to why a single incentive reduced the uptake compared to the control group. Results show an adverse effect of the single €10 incentive that is not present if two smaller incentive sizes (€5) are offered (supporting hypothesis 2). Anticipatory utility may explain a preference for €5 now and another €5 later but does not account for the negative effect of a single offer of €10.

A positive (but less) significant effect of the single €10 could be simply interpreted as a preference for segregated gains. A nonsignificant effect of the single €10 incentive could be interpreted as the incentive not being appealing enough and corroborate the evidence from meta-regression in chapter 4 that cancer screening is particularly resistant to the offer of incentives. However, a negative effect compared to the control group suggests a crowding-out effect that could be explained by incentive size. Several justifications based on incentive size are offered for this result.

Firstly, the €10 incentive may trigger higher levels of risk perception. Patients may interpret higher incentives as a signal of a greater need or urgency to perform screening. Benabou and Tirole (2003) show that higher rewards may diminish the agent's performance as they represent the principal's better information on the task; patients may see it as negative information about their health status. The offer of €10 is not particularly high but for a population that is not accustomed to monetary offers in health contexts, it may have a signalling effect and prompt some to be concerned about screening and diagnosis risks. Smaller incentives at different points in time may minimise risk perception and still be motivating without becoming threatening. The preference for spreading outcomes seems particularly important when there are costly events in the sequence. Starting and finishing with a gain may fade the perceived risks of the screening process.

Secondly, and with similarities to the first explanation, higher incentives may increase attentiveness toward the complexity and length of the screening process (Von Thadden & Zhao, 2012). The interpretation of the principal-agent theory by Benabou and Tirole (2003) also states that a higher incentive may signal the task is onerous,

complex or difficult. Moreover, higher incentives may prompt a cognitive overload by pressuring individuals to completely understand the task or think more about it (Ariely et al, 2009) which may lead to avoidance, particularly in an older population. Smaller incentives may promote a better understanding of the screening process by creating a more manageable level of attention given to the decision to undergo (or not) screening.

Thirdly, a different explanation is based on research about "protected values" (Baron & Spranca, 1997) or "sacred values" (Tetlock et al 2000) results – in much a similar way to the case of blood donation. This line of research proposes that there are some human exchanges that should not be traded off against money. Many older people have a close and trusting relationship with their doctors (Wrede-Sach et al, 2013) and patients may feel suspicious and sceptical about a monetary offer that they deem unnecessarily high in exchange for a behaviour they should perform for free. However, the offer of two smaller €5 incentives may have been interpreted less as a monetary offer and more as a symbolic gift. For older people, the doctor-patient relationship can be considered particularly sacred and be more responsive to small size incentives. If this assumption is correct, segregating incentives may have a potential double positive effect: it may not only increase the overall subjective value of the incentive by fostering anticipatory utility and providing hedonic gains from temporally spread benefits; but also may avoid the perception of economic transactions in the patient-doctor relationship by keeping incentive size low.

Fourth and final, a large incentive for screening can be perceived as an inappropriately high compensation for a behaviour that patients should be doing regardless of payment. This may lead to distrust towards the health organisation, particularly a public health centre, which is in essence characterised by providing free care (in itself already an embedded financial incentive) in the name of social welfare. Screening is supposed to be a procedure improving only the health of the patient but a high incentive may point out that the organisation has concealed interests related to the screening of patients, other than patients' own health.

This study also provides an indirect evaluation of the 'optimal' level of incentive size. By segregating the offer of a single €10 incentive into two €5 incentives, I show that people code incentive offers not by their overall payoff but by a unit of reference – probably the value of each single unit of incentivisation. This could be interpreted as a test for the effect of incentive size. If patients show a preference for receiving €5 each time instead of €10 – despite the overall payoff being the same - this suggests that small

incentives around €5 may be a good estimate for the 'optimal' incentive offer – at least for health care compliance. An incentive of €5 may correspond to an incentive of $5 (as suggested my meta-regression in chapter 4) or £5: although the absolute value is not the same, these may be psychologically equivalent in terms of unit of incentivisation. This i still a hypothesis for future studies because although my results suggest this possibility, I cannot strictly draw this conclusion from my research design.

6.6.1 Policy implications

The main contribution to policy is empirical evidence recognising that the temporal framing of health behaviour matters. How the compliance process is framed to patients may be critical to promote health behaviour. If no incentives are offered to increase compliance, the health procedures should be integrated as much as possible i.e., describe colorectal cancer screening as single articulated process. Given that compliance is likely to be perceived as an immediate cost to patients, losses (screening steps) should be integrated. But if some incentive is offered to patients, this gain should be segregated and highlighted to patients.

If the health compliance process is simple e.g., attending a medical appointment, patients should be informed that the incentive will be given at the end: cost (appointment) followed by a gain (incentive), benefiting from people's preference for improving outcomes. However, if compliance is more complex and lengthy, the overall available incentive amount (e.g., £20) should be distributed in such a way that it accompanies patients in the completion of the health process. For instance, many vaccines can also be easily framed as a multi-step procedure given the need for multiple immunisation dosages e.g., HPV, MMR or hepatitis B. In this situation, incentives could be distributed as £10, 0, £10 or £5, £5, £10, both distributions being predictably better than a single offer of £20 at the end of the process. Incentives offered in this and similar contexts could benefit from segregation. The offer of a single incentive contingent with the uptake of screening is the standard approach used in previous incentive health interventions (all studies discussed in the systematic review in chapter 4 have followed this pattern) but our results suggest that a single offer at the end the process may not be as effective as multiple incentive moments. Smaller incentives offered throughout the screening procedure may help smooth the process along. Several smaller incentives may engage patients in the screening process by incentivising the initial enrolment and facilitating screening completion.

Medication adherence is one of the most favourable contexts to apply mental accounting principles. Adherence to medication schedules usually involves a sequence of adherence moments e.g., a pill twice a day for seven days. Research on medication adherence, mostly in the area of contingent management for substance users, tested different profiles of incentive offers (Petry, 2000): constant, increasing and, less frequently, an increasing profile that is reset to the minimum amount when patients miss a dose (Higgins et al, 2012). This research has mostly shown that increasing offers of incentives are more effective than constant ones but no other incentives distributions have been tested so far. Contingent management for substance users has been greatly influenced by operant conditioning and behaviour modification techniques but not behavioural economics and mental accounting. There is a gap in research for the application of U-shaped incentive schemes in long adherence schedules.

An interesting aspect of this study is the considerable uptake of the control group (56%) without any offer of incentive. This rate is significantly superior to previous historical rates reported by the health centre (25%-30%) without this systematic invitation for screening. This suggests that the simple invitation of patients by letter without further incentivisation was suitably appealing to this older population. The results from my control group are similar to the only two pilot studies performed by the National Health Authorities, also just simply using an invitation letter with no incentive offer. In 2011, 3225 patients were invited to perform screening of which 55% attended (ARS Alentejo, 2011). In 2012, 7957 patients were invited and the uptake rate was 48% (ARS Alentejo, 2012). In my study, considering only the 'two incentive' group tested in this study – because the single incentive had a negative effect in screening rates - results show an absolute risk reduction (ARR) of 8.3% by offering financial incentives, corresponding to 151 people needing to be incentivised to avert one future case of cancer – assuming a 8% prevalence rate from Ferlay et al (2007). The cost per returned test according to the health centre management is estimated to be €11, to be added to the incentive value to calculate an on overall intervention cost.

6.6.2 Limitations and future studies

Information about patient income and past compliance with screening could not be extracted from national health records. This implies that my research question 3 could not be examined in the study – as in the previous chapter for the case of Chlamydia screening. Furthermore, past compliance behaviour could have been a particularly

relevant aspect to control for because there is evidence for colorectal cancer screening (Redelmeier & Kanheman, 2003) that memories of past procedures interfere with future willingness to perform screening – and how this past evaluation of screening interacts with a present incentive offer is an important question to answer.

In this case, it was also not possible to collect data on the potential psychological mechanisms underlying these results like e.g., sensitivity to rewards or risk perceptions, to support my post-hoc explanations, although for reasons somewhat different from the Chlamydia study. Given the age range of patients (50-74), individuals would need to be contacted by phone or a survey should have been mailed with the invitation letter (considering that an online survey would not be appropriate for such an older sample). Nonetheless, (i) information about telephone contacts was not disclosed by the health centre due to confidentiality concerns and (ii) a mailed survey would introduce the same risk for self-selection bias as in the Chlamydia study because only patients with particular characteristics (e.g., higher educational level or literacy) could feel inclined to answer.

Future studies should try to disentangle more clearly the underlying effects explaining the results of this study and understand the reasons behind this crowding-out effect for a single incentive. The 'two incentive' group could have been the most effective intervention because (i) it benefits from a segregation of gains, (ii) it spread gains that covers more evenly the screening procedure and (iii) kept each incentive offer lower. These different effects may have worked independently or as complements and there may have been one effect which was dominant. This is a valid theoretical question and a crucial concern for similar future health interventions to determine incentive design i.e., is it more important to segregate or keep incentives small?

Furthermore, most of my proposed justifications were based on incentive size but other different explanations could be examined. For instance, there could be aging effects involved. Research has shown that older people respond to framing effects similarly to younger people (Strough et al, 2001) and thus not likely to be a narrow choice bracketing problem (Read et al, 1999). But they do respond to uncertainty differently – older adults weigh certainty more heavily than younger people (Mather et al, 2012). A single incentive offered at the end of a lengthy screening process may sound uncertain and its value being heavily discount by older people – to the point that it becomes a disincentive.

Chapter 7

General Discussion

The offer of contingent financial incentives has a long tradition in behavioural change interventions and has recently regained momentum as a strategy to promote individual health behaviour. However, patient financial incentives are still controversial as a policy tool in developed countries and some fundamental questions had not yet been answered in the literature.

I outlined the main research gaps to be tackled in three research questions: (1) Are patient financial incentives effective? (2) Which sort of incentive is more effective? (3) Are income and past behaviour effect modifiers of the impact of incentives? These questions were posed for both blood donation and compliance with health care. On one hand, blood donation has long taken a leading role in the discussion about the potential detrimental effects of offering money in exchange for health behaviours and a discussion based on empirical evidence was long overdue. On the other hand, compliance with health care involves a large set of behaviours with an influential impact in patient health and overall health expenditure. Health care compliance was defined as the extent to which people comply with health recommendations (according to WHO, 2003) and I particularly analysed compliance with one-shot or short-term health behaviours – appointment keeping, cancer screening, TB screening, STI screening, treatment adherence and immunisation.

Two meta-analyses and two field studies developed within the scope of this thesis allow me to answer these three research questions for both contexts, albeit with different degrees of comprehensiveness. Table 7.1 summarises the main findings of this work that will be further discussed next.

	Research Questions		For Blood Donation	For Compliance
1	**Are incentives effective?**	**Blood quantity**	**No**	**Yes**
		Blood quality	Possible adverse effect	
2	**Which sort of incentive is more effective?**	**Type**	No difference between financial and nonfinancial incentives	**Segregated incentives** Gain-framed and offered with certainty
		Size	**No impact of incentive size**	**Small size incentives <=$10**
3	**Are income and past behaviour effect modifiers of the impact of incentives?**	**Income**	Indirect evidence suggesting low income donors are more attracted by incentives	**Incentives are more effective for low income patients**
		Past behavior	**No difference between first-time and previous donors**	Evidence suggesting incentives work mostly in past non-compliers

Table 7.1 Summary of the main findings of this work

I fundamentally contribute to the literature by showing that financial incentives should not be considered a panacea to promote changes in health-related behaviour. Standard economic theory and operant conditioning make general predictions about how behaviour will change in response to changes in incentive structures – incentives that allegedly induce cost-benefit calculations and rational choice. These general predictions can be basically summarised in three main assumptions: (1) financial incentives will increase the likelihood or frequency of behaviour; (2) behaviour is a positive monotonic function of incentive size i.e., the larger the incentive, the higher the likelihood of behaviour change and (3) incentives have a higher impact on low income people because of diminishing marginal utility of income. I show that by and large most of these assumptions do not hold in the contexts of blood donation and health care compliance.

The *first assumption* is robustly disproved for blood donation and is conditionally accepted for health care compliance, dependent on the particular health setting and incentives used. For health care compliance, the impact of financial incentives ranged from strongly positive (e.g., TB screening or appointment keeping in meta-regression) to detrimental (the single incentive in the colorectal cancer screening study). The non-significant effect of incentive features in the meta-analysis about compliance in chapter 4 likely reflects this need for conditionality in the use of incentives in this context; a lack of a positive effect may be explained by a cancellation effect due to conflicting positive and adverse impacts of incentive offers.

The *second assumption* is also not supported for blood donation. Although some individual studies suggest a positive effect of high incentives $15+ (Lacetera et al, 2012; Iajya et al, 2013), these results reflect (albeit significant) very small effect sizes (e.g., 0.08% increase). I propose that incentives do not work to motivate 'altruistic' blood donors but may attract a few blood 'sellers'. And blood 'sellers' respond to incentive size but the numbers of blood sellers that incentives attract is not sufficient to have a considerable impact on overall blood rates. For health care compliance, there was evidence of an opposite direction: incentives >=$10 may actually have a negative effect in the likelihood to comply. I propose that, in this case, incentives are effective - generally speaking - but mostly by working as motivational levers that trigger people to take care of their own health – a goal people already have at baseline but that may not be too salient in daily life. Thus, small incentives work better than higher incentives

because small size rewards can be more easily interpreted as prompts or reminders compared to higher incentives, which may raise risk perception or suspicion alerts. The threshold for this differentiation seems to be around $10: incentives lower than $10 are more effective than higher incentives.

The *third assumption* seems to be the exception. I could not show from the available evidence that financial incentives attract low income blood suppliers – there was no research providing data on this. But the fact that studies on the impact of blood quality suggest a negative effect of incentives may be symptomatic that incentives catch the attention of people with poorer health status – unlikely to come from affluent socioeconomic backgrounds. And this third assumption was strongly supported for health care compliance: low income patients are 2.5 times more likely to comply with health care when offered a financial incentive.

Taken together, my results are indicative of support for Thaler and Sunstein (2008) proposal that sensible choice architects choose the right incentives for the right people in the right context. However, it does not seem to be strictly a question about the cognitive effects of changing framing and salience – as these authors defend – but also a question of considering social preferences when planning to use incentive schemes. I endorse that differences in the effect of incentives between blood donation and compliance are mostly explained by social preferences whereas differences within each of these health context are likely to be explained by framing and salience effects.

For blood donation, incentives are offered in exchange for a behaviour that strictly benefits the health of others. For compliance, incentives are offered for people to take care of their own health. As I previously mentioned, there is evidence that monetary incentives have been proven detrimental to 'other-regarding' preferences by triggering self-interest (Bowles, 2008): the mere priming of money has been shown to increase selfish behaviour (Vohs et al, 2008). Thus, financial incentives may crowd-out nonmonetary motivations – acting as substitutes. Financial incentives should then be used only to trigger self-interested behaviour like the individual uptake of health care but not to increase prosocial behaviour as blood donation.

Changes in the framing, salience, type and size of incentives seem to work within the boundaries previously delimited by social preferences. More clearly, in the case of blood donation, where incentives do not seem to be an adequate intervention, changes in the design of incentive schemes have little room to work. Hence the lack of

significant differences between lotteries, vouchers, gifts and incentive sizes ranging from $3 to $23.

But in the case of health care compliance, for which incentives match the self-interest nature of this context, it is important to understand how patients code, organise and structure the information about the financial incentive offer. For instance, in the Chlamydia study the £5 voucher increased screening from 1.5% to 22.8% while the £200 lottery only generated a 2.8% screening rate. The certainty effect (Kanheman & Tversky, 1986) is likely to be underlying this result – and producing a massive 20% difference. In the case of colorectal cancer screening, using a cognitive framing effect of segregating versus integrating the overall payoff offered to patients has an extreme impact. Compared to the control group, offering two €5 separate incentives increased screening rates by 8% whereas offering a single €10 incentive decreased the uptake of screening by 12%. And these differences were produced by changes in information framing. The minor differences found in blood donation studies do not compare with the magnitude of the differences found between incentive schemes in the case of health care compliance.

After this overall assessment of my research results, I will now summarise how I have addressed each of the research questions I initially proposed.

7.1 Are financial incentives effective?

Incentives are not effective to increase blood donation. This statement is based in the systematic review and meta-analysis performed for blood donation. For quantity of blood donated, there was a null effect of offering patient financial incentives. Although the meta-analysis for quantity of blood donated included a limited number of studies (six studies), it nevertheless comprised a total sample of 93,328 individuals and the overall estimate was robust to sensitivity analyses. The statistical heterogeneity found between-studies was moderate and an overall estimate based strictly on high quality studies with large sample sizes still showed no effect of incentives.

I took the quantity of blood supplied upon the contingent offer of an incentive as a proxy for Titmuss' argument of economic efficiency. Titmuss never claimed that blood quantity would decrease if incentives were introduced, contrary to common belief. The result of the null impact of incentives to increase blood donations is a positive reply to Titmuss' hypothesis. According to the available evidence, incentives

are economically inefficient because, given the same amount of blood donated, the cost per unit from paid suppliers is higher than that from unpaid donors.

With respect to the quality of the blood donated, results are less robust but suggest an adverse effect. The analysis for quality of blood donated was based on two experimental studies and 13 observational studies, which provided a less reliable source of information given the mixed data from donors and units of blood, and the lack of specification for paid versus unpaid donors. Despite the need for caution in the interpretation of this data, nevertheless it should be emphasized that these observational studies involved 454,653 participants. This observational data strongly suggested an adverse effect of incentives if offered not contingent upon quality of blood. Was Titmuss right to be concerned? Apparently yes.

Can these results be taken as evidence of crowding-out? Strictly according to the operational definition I used, results do not support a crowding-out effect. Motivational crowding-out was defined has a negative effect of offering incentives, measured as reduced levels of blood donation in the incentivised group compared to the control group. There was a null – but not negative – effect in blood quantity and therefore it cannot be said that incentives have a crowding-out effect. But for blood quality, there seems to be a crowding-out effect if incentives are not offered conditional to a quality control. But given that the opposite is found when incentives are contingent upon quality and the fact that observational data is prone to self-selection bias, I cannot draw a precise conclusion.

This definition of motivational crowding-out was chosen because (i) it fits the policy and economic perspectives that consider crowding-out as an inverse income effect and (ii) analysing the immediate impact of incentives allows us to analyse a broader range of studies because very few studies analyse what happens to behaviour after incentives are no longer offered. However, I am only observing external effects. Titmuss' notion of 'crowding-out' (he never coined the term) was broader and more difficult to measure. He was concerned with more than a possible adverse effect in blood supply. He was mainly troubled about "*the consequences, national and international, of treating human blood as a commercial commodity*" (p.58). Titmuss was compelled to raise these questions to understand the "*extent to which specific instruments of public policy encourage or discourage, foster or destroy the individual expression of altruism and regard for the needs of others*" (p.59), over and above the specific context of blood donation, which worked mainly as a symbol of humanity. And

it should be emphasised that claiming no evidence of motivational crowding-out is based on a very narrow and restricted definition.

Incentives may have some crowding out effect on who donated rather than how many donated. For example, incentives may have distanced voluntary donors and attracted new, incentive-driven donors without affecting the overall number of donors. I cannot evaluate the latent negative externalities in human motivation and altruism caused by the transaction of blood but can simply say that paying for blood is not effective.

Incentives are effective to increase health care compliance. I base this claim on the results of the systematic review and meta-analysis of 20 experimental studies involving 151,875 participants. Results showed that patients offered financial incentives are about three times more likely to comply with health guidelines. If I restrict my conclusion to the results from high quality studies, I can say that the likelihood of complying with health care increases about 40% in the presence of incentives. However, the overall positive estimate enclosed substantial between-studies heterogeneity, suggesting the importance of analysing the key effect modifiers of this general effect.

Financial incentives were significantly effective to increase compliance with TB screening, appointment keeping and treatment adherence. In contrast, incentives were less effective in promoting immunisation and do not have a significant impact in increasing cancer and STI screening.

On one hand, this effect may be grounded on the specificities of the barriers reported for noncompliance. For instance, people forget their appointments because they have unexpected competing activities or, in-between, their health status improved. People do not tend to miss appointments due to the high disutility of complying. These common barriers may be reasonably well addressed with the offer of a financial incentive. For treatment adherence, incentives may be effective to address memory lapses with medication schedules or compensate the discomfort of side-effects of treatment. But the barriers reported for missing cancer or STI screening are more complex and thus suggesting that compliance has higher perceived costs for patients. The psychological costs of screening are often disregarded in the analysis of poor screening rates (Marteau, 1989; Lerman et al, 1991; Wardle & Pope, 1992). The utility of not complying with screening guidelines may be perceived as superior to the disutility of receiving a possible positive result. Nevertheless, taking both contexts that were shown resistant to incentives in meta-regression – STI and cancer screening - I

showed in two field studies that incentives may be effective if well-informed by behavioural research. It seems that, for simple barriers to compliance, standard applications of incentives are enough to increase compliance but, to address more complex barriers, behaviourally driven incentives schemes may be necessary.

On the other hand, there is also the possibility that the association between health setting and the effect of incentives is spurious and explained by covariates unrelated to the barriers underlying each health setting. Both incentive size and patient socioeconomic status appeared to be associated with the substancial variability explained by the health setting under analysis – and I will discuss this alternative explanation in the answer to the next research questions.

Claiming that incentives are effective to promote health care compliance implies that no evidence of motivational crowding-out was detected – according to the economic definition. I found no evidence of a negative effect of incentives in the meta-analysis and the chlamydia study. But a significant negative effect was found in the colorectal cancer study, with the uptake of screening in one incentive group significantly lower than the control group. This evidence indicates that the significant positive estimate for the impact of incentives does not preclude possible negative effects, further corroborating the need to identify critical effect modifiers that explain these exceptions.

7.2 Which sort of incentives is more effective?

Given that no significant effect was found for blood donation, this question becomes less meaningful. Corroborating the overall estimate, **no significant differences were found between different types of incentives**. The financial incentives that were offered included money, vouchers, gifts, lottery tickets and cholesterol tests, with an estimated value between $3 and $23. The overall null effect of incentives in blood donation that remained stable if different types of incentives were separately examined. However, this conclusion is based on very small subgroup analyses that did not allow a more formal test with meta-regression.

The lack of difference between types of incentive in blood donation is an important contribution the literature. There has been a considerable debate about where a distinction may lie between financial incentives as cash or lotteries and non-financial incentives as gifts and medical tests. The former tends to raise more opposition whereas

the latter is more commonly assumed as a more legitimate or effective way to incentivize blood donation (Costa-i-Font et al, 2013; Sass, 2013; Lacetera & Macis, 2010a). My results showed that what I considered financial (cash and vouchers) and nonfinancial (gifts as t-shirts or medical tets) incentives are equally ineffective. However, I could not test the impact of cash versus other incentives because only one study offered cash (Mellstrom & Johnassen, 2008) – probably this lack of evidence reflects the expected negative effect of cash in donation rates. These authors did find a negative significant effect of offering cash; however, their sample was self-selected and composed of people already motivated to donate blood. It could be the case that money crowds-out voluntary donors or simply any incentive could have this adverse effect on commited donors.

A possible criticism for this lack of significant effects is that the size of the incentives offered was not sufficient high to motivate behaviour (Lacetera et al, 2013). However, with respect to incentive size, my results show no significant differentes between low (=<$5), medium ($5+-$15) and high ($15+) incentives. I also discussed the possibility that individual studies may show a different picture, as proposed by Lacetera (2012) and Iajya et al (2013). Lacetera et al (2012) defended that $15 gift cards were effective to increase blood donation but this change was from 0.6% to 1.7%, which is a nonsignificant difference when the estimates are adjusted for the cluster design of this study. Iajya et al (2013) reported that incentives corresponding to US$14 and US$23 significantly increased blood donation but report changes from 0% (no incentive and $5 incentive) to 0.4% and 0.8% respectively. This could hardly be considered evidence for effectiveness. Thus, I argue that the impact reported in these studies is negligible.

Curiously, the same authors who suggested the problem with lack of incentive effects could be overcome with high incentives (Lacetera et al, 2013) had previously proposed that incentives should be symbolic (Lacetera & Macis, 2010b). There is in fact evidence that very small incentives (as low as $1) can change behaviour considerably in other health domains as compliance (e.g.,Helmus, Saules, Schoener, & Roll, 2003; Malotte, Rhodes, & Mais, 1998; Tulsky et al., 2000; Volpp et al., 2008). However, blood donation seems particularly resistant to the impact of incentives – high or low, financial or nonfinancial.

For health care compliance, small incentives <=$10 (£5) framed as gains and given with certainty should be used. This statement is based on both field studies

and, to a lesser extent, meta-regression results. Meta-regression did not clearly support the use of a particular type of incentive but identified some tendencies.

Meta-regression showed the puzzling tendency for a negative effect of incentive size. I provided field evidence that, in fact, there may be a crowding-out effect of high incentives in the case of compliance – at least compliance with cancer screening. I compared the offer of a single (€10) versus double (€5x2) incentive offer and showed that – compared to no incentive - the single incentive was significantly worse but two incentives significantly better. It is not indisputable that the justification for this result lies in the incentive size but I have no reason to rule out this explanation either. Small incentives seem to provide sufficient motivation to comply with health guidelines without raising red flags – related to motivation effects or risk perception. Incentive size also seems to be associated with the health settings in which incentives were and were not effective. Results from a nonparametric test (Mann-Whitney U test) showed the health settings in which incentives had an impact had average offers under $10. This simple analysis cannot be taken as evidence of causal effects but seems to reinforce the patterns from a greater impact of low incentive offers to promote compliance with health care.

Higher incentives may increase perceived risk by signalling a potential threat, create a cognitive overload or because higher incentives are already targeting more complicated and resistant health behaviours at baseline. An alternative justification is based on the concept of motivational crowding-out. Under the offer of small incentives, people maintain their perception of autonomous behavior, whereas higher incentives draw attention to the external control of patients' decisions. Regardless of the explanation, there is a counterintuitive negative effect of incentive size when offered for compliance with health care. And this result is consistent with a rising number of papers revealing a nonmonotonic relationship between incentive size and behaviour (Gneezy & Rustichini, 2000; Ariely et al, 2009; Pokorny, 2008) – which may ultimately be considered also an expression of motivational crowding-out effets.

Although not a particular type of incentive per se, I showed that incentives framed as potential gains were more effective than incentives framed as potential losses. This result does not support common assumptions based on Prospect Theory and loss aversion which often presume a superiority of loss-framed information. I defend two main possible hypotheses for this result. One justification is based on the discrepancy between stated versus revealed preferences: the work by Alk et al (2011) showed that

health message framing is more effective at producing changes in attitudes and intentions than actually altering health behaviour. Most previous work presenting evidence about the impact of loss aversion is based on self-reported choices between hypothetical alternatives (Kanheman & Tversky, 1979; Baumesteir et al, 2001) and not real behaviour. Research from operant conditioning – which only analyses behavioural outcomes - has consistently failed to prove the higher impact of punishement over reinforcement to promote behaviour change (Postman, 1947; Magoon et al, 2008).

My work, nonetheless, does not provide behavioural data comparing gains versus losses – it is restricted to the analysis of framing effects of incentives offers. And in that sense, I resort to a related research on framing negotiation offers. Negotiation offers framed as gains to the other party lead to better outcomes than loss framed offers (De Dreu et al, 1994). Framing an incentive offer as a potencial gain may create a positivity effect and suggest to the agent that the principal cares about his well-being (Benabou & Tirole, 2006). Incentive offers have been shown to increase positive mood (Meloy et al, 2006) for which gain-framed messages are more congruent than loss-framed messages.

Meta-regression did not support a preference for cash or incentives given with certainty. However, I compared a £5 voucher with a £200 lottery voucher and found a clear support for a higher effectiveness of the small certain voucher in the case of Chlamydia screening. The expected value for the two incentives could not be matched and thus my conclusion is based on a preference for certainty and not expected value. My results corroborate Zenner et al (2012) large observational study showing that vouchers (and not lotteries) cause the positive effect of incentives upon increased Chlamydia screening. I propose that, in the case of an activity which requires an immediate effort and creates uncertainty as it is the case of disease screening, a certain reward (even if small) is more effective than a larger prize draw. Meta-regression results include a variety of health settings and perhaps a preference for incentives offered with certainty is higher in the case of screening i.e., an activity for illness detection with a higher perceived risk than appointment keeping or adherence to medication.

7.3 Are income and past behaviour effect modifiers of the impact of incentives?

For blood donation, there was no evidence to inform about the role of income and **no difference was found between first-time and previous donors**. The limited evidence

for blood donation only allowed performing a subgroup analysis between participants who were first-time donors and experienced donors, showing no difference.

The available studies did not include information about donor income and therefore, it was not possible to test the validity of Titmuss' concern about incentives attracting more deprived people. Nonetheless, the fact that studies on the impact of blood quality suggest a negative effect of incentives may be indicative that incentives attract more deprived people with a poor health status.

Incentives are significantly more effective to increase health care compliance in low income people but no evidence to analyse the role of past compliance behaviour. Meta-regression showed that incentives strongly increased the likelihood of low income people complying with health care, 2.5 times more than higher income patients. The fact that incentives were extremely effective in promoting TB screening is most likely explained by the characteristics of the participants targeted in such studies - deprived individuals, many of which unemployed or even homeless.

No definitive conclusion could be drawn about the impact of past compliance behaviour in the effectiveness of incentive offers. There was a single study included in the qualitative review in chapter 4 that reported on this difference (Stoner et al , 1998), which showed that the offer of a voucher for free mammographies was only effective to promote screening in previously non-compliant women but was indifferent to woman that were already compliant with screening.

7.5 Main contributions to behavioural research

All empirical chapters in this thesis are innovative pieces of work in their own right and I make several crucial contributions to behavioural research.

To the literature about *motivational crowding-out effects*, I contribute with three main results. Firstly, there is no evidence of a motivational crowding-out effect when financial incentives are offered to increase blood donation – according to our restricted definition. This result does not differ according to the type of incentive offered i.e., financial or nonfinancial incentives. Secondly, I provide the first ever evidence of a crowding-out effect of positive financial incentives in the field. Evidence for motivational crowding-out in the case of positive incentives (rewards) was only based on stated preferences (Frey & Oberholzer-Ghee, 1997; Frey & Goette, 1999) or lab studies (Ariely et al, 2009; Pokorny, 2008). Evidence from the field is strictly related to

unexpected effects of penalties (Gneezy & Rustichini, 2000; Holmas et al, 2010). I show that a positive incentive of €10 significantly decreased compliance with cancer screening in naturalistic setting. Thirdly, and closely related to this second result, I show that, in the context of compliance with health care, smaller financial incentives are more effective to promote behaviour change. This negative effect of incentive size is a contribution to behavioural research by demonstrating a clear departure from standard economic assumptions – namely that, the higher the incentive, the higher the likelihood to promote change. I add to the limited studies suggesting this effect (Ariely et al, 2009, Pokorny, 2008). And this preference for receiving small incentives seems to be related to the value received per unit of incentivisation and not the overall payoff from the incentive.

To literature about *mental accounting and preferences for sequences of events,* I make a dual contribution. On one hand, I show that people prefer segregated gains and spread benefits when faced with a three-outcome situation distributed over time. To date, research had mostly focused on choices of a single outcome (now versus later or close future versus far future) or choices involving the preference for a sequence of two events, usually showing a preference for improving outcomes. There were only a couple of papers in the literature (Loewenstein, 1987; Loewenstein & Prelec, 1991, 1993) examining the joint evaluation of three outcomes, proposing a preference for benefits spread over time. I add to this scarce evidence by corroborating that people prefer benefits to be distributed over time instead of having concentrated gains in the beginning (classical time discounting hypothesis) or the end (preference for strictly improving outcomes). On the other hand, I make a significance improvement in terms of external validity by testing and supporting these temporal preferences in the field – which is the first study to date to provide such evidence – and showing the independent main effect of segregated gains.

To the literature about *messages framing*, I contribute by showing that gain-framed incentives are more effective at increasing compliance with Chlamydia screening than loss-framed incentives. Moreover, I demonstrate this effect with field data from a randomised controlled trial, providing higher quality evidence than previous studies – mostly based on self-report measures. Prospect theory spurred a considerable interest and research about the framing of health messages. Heavily influenced by the predictions of loss aversion in the case of risky financial decisions, research on health messages often assumes that loss-framed messages are more effective in promoting

behaviour change (Rice, 2013). However, research about the framing of health outcomes may not be directly comparable with research about incentive messages framing. The few studies claiming to test gain-framed versus loss-framed incentives showed mixed evidence (Goldsmith & Dhar, 2013; Romanowich & Lamb, 2013; Roll & Howard, 2008). However, these papers actually test different types of incentives, not framing effects. Comparing a condition in which patients accumulate rewards starting at zero with a condition in which patients receive an initial endowment from which deduction are made is not a framing effect. This is the difference between using positive and negative reinforcement dicussed in table 2.1 (p.47) which have different motivational properties. I present evidence for a positive impact of gain versus loss framed incentives in the strict sense – just a change in wording in the information given about the incentive offer.

Overall, I also contribute to the discussion about the *relative contributions of standard versus behavioural economics*. Standard economic theory is a general normative and prescriptive model of choice whereas the strength of behavioural economics relies in its descriptive validity. Debates over the quality and validity of both standard economic theory and behavioural economics models have been mostly been framed as horse race aiming to establish which is best (Harrison & Rutstrom, 2009). But increasingly more researchers are expressing more reconciliation and contingency (Harrison & Rutstrom, 2009). I propose that this view is demonstrated by my results. The meta-analysis about compliance shows a positive effect of incentives, regardless of type or size. In the Chlamydia study, both incentives significantly increased screening although the voucher was particularly effective. In the colorectal cancer study, two incentives were preferred to a single incentive. All this could be predicted and explained by standard economic theory, with cost-benefit calculations and anticipatory utility. However, one needs to resort to behavioural economics to explain why incentives do not work to promote blood donation, why a single incentive has a detrimental effect compared to two incentives proving the same overall payoff or why incentive size may have a negative effect.

I proposed self-interest behaviour versus 'other-interest' behaviour as a crucial dimension to clarify the relative contributions of standard versus behavioural economics but this argument is not exhaustive. The relative predictive power of standard economic theory versus behavioural economic theories should be further analysed by task domain and target population (Harrison & Rutstrom, 2009).

7.6 Policy Implications

My results have several important policy implications. First and foremost, the offer of financial incentives is not recommended to promote blood donation, regardless of incentive type. It is expected to have a null impact in the quantity of blood donated and a possible adverse effect in blood quality. This result is critical and timely: there have been recent public endorsements of the use of financial incentives to promote blood donation, claiming to be based on empirical evidence. In a recent influential paper in Science, Lacetera and colleagues (2013) claim that "*there should be little debate that the most relevant empirical evidence shows positive effects of offering economic rewards on donations*" (p.928). This bold claim has already had a significant impact in the media and policy audiences[6][7][8] but my results, based on a comprehensive synsthesis of the literature, do not support this statement.

For compliance with health care, incentives are expected to work particularly to address simple barriers to compliance and for patients with lower socioeconomic status. For these contexts and patients more responsive to incentives, it does not seem to any particular requirement regarding the incentives to be used. Small size incentives, preferably certain and not under the format of prize draws, are likely to be effective. Results showed that vouchers seem to be as effective cash and more easily managed from an administrative and ethical point of view.

This rationale poses an important cost-effectiveness question though. If financial incentives appear to be effective in increasing health care compliance mostly in cases where minor barriers are identified and are less likely to improve compliance when more complex barriers are reported, then it is reasonable to assume that alternative non-financial interventions such as simple reminders or opportunistic screening should be implemented as these would likely provide a higher value for money. For sensitive health contexts as STI screening or cancer screening either (i) compliance is promoted by using incentives well-informed by behavioural research taking in consideration the characteristics of patients and contextual setting or (ii) other nonfinancial interventions.

However, the empirical test of financial incentives is not the only consideration if these interventions are contemplated as policy tools. Moral judgments that are not

---

[6] http://releases.jhu.edu/2013/05/23/offering-economic-incentives-to-attract-blood-donations-should-be-encouraged-researchers-write-in-science/

[7] http://newsroom.iza.org/en/2013/05/24/economic-incentives-increase-blood-donations-without-negative-consequences-iza-fellows-write-in-science/

[8] http://www.themunicheye.com/news/Economic-incentives-increase-blood-donations-2770

about the readily measurable consequences also play a part. For instance, Titmuss's arguments against the use of incentives in blood donation had deep roots in his humanist conception of social policy as a tool for human progress that should be protected from what he considered to be exploitative economic interests. He endorsed blood donation as a core example of how society should be governed by relationships characterized by reciprocity. Regardless of the effectiveness of incentives to increase blood stocks, paid donors become blood sellers and blood donation becomes blood supply. Regarding compliance with health care, studies on the public acceptability of incentives (Promberger et al, 2012; Parke et al, 2011) also suggest that the effectiveness of incentives should be balanced with their acceptability in the target population when designing incentive schemes. Vouchers – from both an effectiveness and ethical perspective – appear to be the best option.

As I have discussed, the higher impact of incentives in patients facing high economic deprivation puts forward the possibility that incentives could be used as a policy tool to tackle health inequalities (Oliver & Brown, 2012). This is still a divisive topic, not necessarily dependent on effectiveness results. Targeting certain social groups may be controversial because of unfairness perceptions from untargeted groups (Oliver, 2009). Also, public acceptability may drive the decision to use financial incentives as a strategy to promote health in more deprived social groups. The general public finds acceptable to offer incentive to low income people when these individuals are not pictured as responsible for their own situation e.g., smokers, drug addicts (Parke et al, 2011). This is a particularly important question because there is a call for tailored health interventions that acknowledge the specificities of different social groups (Michie et al, 2009). Interventions to promote health behaviour have been shown to adversely increase health inequalities, because most interventions rely on the axiom of the impact of information and appeal to long-term health goals. This standard type of intervention may not be productive because more deprived people tend to have lower educational levels and higher discount rates – thus probably more accessible to the offer of immediate rewards.

7.7Limitations and future research

Not a particular limitation of my work - but a limitation that my work exposed – is the scarcity of large well-designed field studies that test the impact of interventions to promote health behaviour. This is limitation was found for interventions using financial incentives but this is also true for other nonfinancial interventions. And this is related to the important question of the comparative effectiveness of different interventions. I tested the impact of offering incentives by comparing them to no incentive (control group). However, for policy making, the crucial question is usually which intervention to use – not if some intervention should be implemented. Therefore, a key point that was not analysed in this work is the relative impact of incentives when compared to other types of interventions as providing information, educational programmes, remainders or practitioner-based interventions.

Two fundamental hypotheses could not be properly tested with secondary data: the impact of negative incentives and the role of past health behaviour. Although the literature suggests a high effectiveness of penalties based on loss aversion from prospect theory (Kahneman & Tversky, 1979), there is no experimental evidence comparing penalties with other types of incentives. In addition, even if penalties were shown to be superior in terms of comparative effectiveness, these negative incentives are likely to be the more difficult type of intervention to implement. Applying penalties involve access to patients' financial resources or providing patients with an initial endowment from which deductions would be made. Furthermore, negative incentives can be more liable to ethical criticisms for inducing avoidable psychological suffering in patients. Moreover, more research on the role of past behaviour for a better understanding of the impact of baseline motivation and habit as moderators of financial incentives.

The cost-effectiveness of patient financial incentives is also a limitation in the contribution of our results. I only provide data about absolute risk reduction and number of patients needed to incentivise to avoid one future case (of Chlamydia and colorectal cancer). There are only a couple of studies examining this topic so far. Gift and colleagues (2005) analysed the cost-effectiveness of a $20 incentive for return to a Chlamydia screening appointment by comparison to a telephone reminder. They showed that the telephone reminder yielded the highest return rate (33%) and was the least costly in terms of cost per infection treated ($622 program, $813 societal). Olmstead and co-workers (2007) compared a prize-based intervention with an expected vaue of $400 for drug abstinence with a control and concluded that the incentive

intervention is likely to be slightly cost-effective. Future research should be developed to examine if incentives are a cost-effective way to promote health behaviour changes – and this is a particular important question under budget constraints.

It remains unknown if alternative strategies such as opportunistic screening in GP practices, offered upon registration with the NHS or other health appointments, which are less dependent on individual initiative, may be more cost-effective. For instance, establishing opportunistic screening as routine and mandatory – as it is already proclaimed for HIV testing (Beckwith et al, 2005) - might offer better uptake rates at no additional cost of further intervention.

Finally, I did not evaluate the long-term consequences of offering patients a financial incentive to comply with health recommendations that, in most cases, they will likely be asked to repeat at some point in the future. Although this is not a limitation *per se* because this question was established *a priori* to be out of my scope, it is nevertheless a question for future research. There are competing hypotheses to be clarified: incentives have a positive, neutral or negative impact on future behaviour according to different theoretical traditions. The clarification of this question is crucial for policymaking to evaluate the sustainability of incentives and discard harmful unobserved effects that could have been triggered by the first incentive offer.

References

Aas, E. (2009). Pecuniary compensation increases participation in screening for colorectal cancer. *Health Economics*, 18, 337-354.

ABC Project (2012). Ascertaining barriers for compliance: Policies for safe, effective and cost-effective use of medicines in Europe. http://abcproject.eu/img/

Abdellaoui, M., Attema, A. E., & Bleichrodt, H. (2010). Intertemporal Tradeoffs for Gains and Losses: An Experimental Measurement of Discounted Utility. *The Economic Journal*, *120*(545), 845-866.

Abel, P. & Esmail, A. (2006). Performance pay remuneration for consultants in the NHS: is the current system fair and fit for purpose? *Journal of the Royal Society of Medicine*, 99, 487-493.

Abellan-Perpinan, J., Bleichrodt, H., & Pinto-Pardes, J. (2008). The predictive validity of Prospect theory versus Expected Utility Theory in health utility measurement. *Journal of Health Economics*, 28(6), 1039-1047.

Abraham, C. & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology*, 27(3), 379-387.

Ackerson, K., & Preston, S. (2009). A decision theory perspective on why women do or do not decide to have cancer screening: Systematic review. *Journal of Advanced Nursing*, 65(6), 1130-1140.

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review, 6,* 107- 122.

Akl EA, Oxman AD, Herrin J. (2011). Framing of health information messages. Cochrane Database Syst. Review.

Alexander, G., Divine, G., Couper, M., McClure, J., Stopponi, M., Fortman, K., Tolsma, D., Strecher, V., & Johnson, C. (2008). Effect of incentives and mailing features on online health program enrolment. *American Journal of Preventive Medicine*, 34(5), 382-388.

Alghurair, S., Hughes, C., Simpson, S., & Guirguis, L. (2012). A Systematic Review of Patient Self-Reported Barriers of Adherence to Antihypertensive Medications Using the World Health Organization Multidimensional Adherence Model. The *Journal of Clinical Hypertension*, 14(12), 877-886.

Ariely, D., Huber, J., & Wertenbroch, K. (2005). When do losses loom larger than gains?. *Journal of Marketing Research*, 134-138.

Ariely, D., Gneezy, U., Loewenstein, G., & Mazar, N. (2009). Large stakes and big mistakes. *The Review of Economic Studies*, *76*(2), 451-469.

Aronson, J. (2007). Compliance, concordance and adherence. *British Journal of Clinical Pharmacology*, 6394), 383-384.

Arrow, K. J. (1972). Gifts and Exchanges. *Philosophy & Public Affairs, 1*(4), 343-362.

ARS Alentejo (2011). Colorectal Screening Pilot 2011 http://www.arsalentejo.min-saude.pt/rccr/Documents/RCCR_Resultados_2011_Evora.pdf

ARS Alentejo (2012). Colorectal Screening Pilot 2012 http://www.arsalentejo.min-saude.pt/rccr/Documents/RCCR_Resultados_2012_Evora.pdf

Aruoba, S. B., & Kearney, M. S. (2011). *Do Lottery Gamblers Love Risk or Overweight Small Odds?*. Working Paper, University of Maryland.

Ashcroft, R., Marteau, T., & Oliver, A. (2008). Payment to look after health: Incentive mechanisms require deeper understanding. *British Medical Journal,* 337: 311-312.

Ashraf, N., Jack, B. K., & Kamenica, E. (2013). Information and subsidies: Complements or substitutes? *Journal of Economic Behavior & Organization*, *88*(C), 133-139.

Ashtonl, C., Haidet, P., Paterniti, D., Collins, T., Gordon, H., O'Mailley, K., Petersen, L., Sharf, B., Suarez-Almazor, M., Wray, N., & Street, R. (2003). Racial and ethnic disparities in the use of health services: Bias, preferences or poor communication? *Journal of General Internal Medicine*, 18, 146-152.

Attanasio, O., Gomez, L., Heredia, P., & Vera-Hernandez, M. (2005). *The short-term impact of a conditional cash subsidy on child health and nutrition in Colombia*. Institute for Fiscal Studies, Centre for the Evaluation of Development Policies.

Baicker, K., Congdon, W. J. And Mullainathan, S. (2012), Health Insurance Coverage and Take-Up: Lessons from Behavioral Economics. *Milbank Quarterly*, 90: 107–134.

Baker, R. (1988). Token Economy in a hospital rehabilitation system. *Journal of Advanced Nursing*, 13, 631-639.

Baker, D., & Middleton, E. (2003). Cervical screening and health inequality in England in the 1990s. *Journal of Epidemiology and Community Health*, 57, 417-432.

Banks, S., Salovey, P., Greener, S., Rothman, A., Moyer, A., Beauvais, J., & Epel, E. (1995). The effects of message framing on mammography utilization. *Health Psychology*, 14(2), 178-184.

Barber, N., Safdar, A., & Franklin, B. (2005). Can human error theory explain non-adherence? *Pharmacy World Science*, 27, 300-304.

Barber, S., & Gertler, P. (2009). Empowering women to obtain high quality care: Evidence from an evaluation of Mexico's conditional cash transfer programme. *Health Policy & Planning*, 24(1), 18-25.

Barham, T., & Maluccio, J. (2009). Eradicating diseases: The effect of conditional cash transfers on vaccination coverage in rural Nicaragua. *Journal of Health Economics*, 28, 611-621.

Baron, J., & Spranca, M. (1997). Protected values. *Organizational behavior and human decision processes*, *70*(1), 1-16.

Bartholomew, L. & Mullen, P. (2011). Five roles for using theory and evidence in the design and testing of behavior change interventions. *Journal of Public Health Dentistry*, 71(1), 20-33.

Baumeister, R.F., Bratslavsky, E., Finkenauer, C., & Vohs, K.D. (2001). Bad is stronger than good. *Review of General Psychology, 5*, 323-370.

Becker, G. (1976). *The Economic Approach to Human Behavior*. Chicago: University o Chicago Press.

Bednall, T. C., Bove, L. L., Cheetham, A., & Murray, A. L. (2013). A systematic review and meta-analysis of antecedents of blood donation behavior and intentions. *Social Science & Medicine*, *96*, 86-94.

Bellows, N., Bellows, B., & Warren, C. (2011). The use of vouchers for reproductive health services in developing countries: systematic review. *Tropical Medicine and International Health*, 16(1), 84-96.

Benabou, R., & Tirole, J. (2003). Intrinsic and extrinsic motivation. *The Review of Economic Studies*, *70*(3), 489-520.

Bénabou, R., & Tirole, J. (2006). Incentives and Prosocial Behavior. *The American Economic Review, 96*(5), 1652-1678.

Berben, L., Bogert, L., Leventhal, M., Fridlund, B., Jaarsma, T., Norekvål, T., Smith, K., Strömberg, A., Thompson, D., & De Geest, S. (2010). Which Interventions are Used by Health Care Professionals to Enhance Medication Adherence in

Cardiovascular Patients? A Survey of Current Clinical Practice. *European Journal of Cardiovascular Nursing,* 10(1), 14-21.

Berger, Z., Kimbrough, W., Gillespie, C., Boscarino, J., Wood, G., Qian, Z., Jones, J., & Shah, N. (2009). Lower copay and oral administration: Predictors of first-fill adherence to new asthma prescriptions. *American Health & Drug Benefits*, 2(4), 174-180.

Berry, S. A., Ghanem, K. G., Page, K. R., Thio, C. L., Moore, R. D., & Gebo, K. A. (2010). Gonorrhoea and chlamydia testing rates of HIV-infected men: low despite guidelines. Sexually transmitted infections, 86(6), 481-484.

Besley, T., & Ghatak, M. (2008). Status incentives. *The American Economic Review*, *98*(2), 206-211.

Bickel, W. & Vuchini, R. (2000). *Reframing Health Behavior Change with Behavioural Economics*. London: Lawrence Erlbaum Associates.

Bleichrodt, H., Pinto, J., & Wakker, P. (2001). Making descriptive use of Prospect theory to improve the prescriptive use of expected utility. *Management Science*, 47(11), 1498-1514.

Bloch, M., Armstrong, D., Dettling, L., Caterino, K., & Barrie, S. (2006). Partners in lowering cholesterol: Comparison of a multidisciplinary educational program, monetary incentives or usual care in the treatment of dyslipidemia identified among employees. *Journal of Educational and Environmental Medicine*, 48(7), 675-681.

Blomberg, K., Ternestedt, B., Tomber, S., & Tishelman, C. (2008). How do women who choose not to participate in population-based cervical cancer screening reason about their decision? *Psycho-Oncology*, 17, 561-569.

Blumenthal-Barby, J. S., & Burroughs, H. (2012). Seeking Better Health Care Outcomes: The Ethics of Using the "Nudge". *The American Journal of Bioethics*, *12*(2), 1-10.

Bokhour, B., Solomon, J., Knapp, H., Asch, S., & Gifford, A. (2009). Barriers and facilitators to routine HIV testing in VA primary care. *Journal of General Internal Medicine*, 24(10), 1109-1114.

Bommier, A. (2006). Uncertain Lifetime and Inter-temporal Choice: Risk Aversion as a Rationale for Time Discounting. *International Economic Review,* 47(4), 1223-1246

Bommier, A. and Villeneuve, B. (2012). Risk Aversion and the Value of Risk to Life. *Journal of Risk and Insurance*, 79: 77–104.

Bonner, S. E., R. Hastie, G. B. Sprinkle, and S. M. Young. (2000). A review of the effects of financial incentives on performance by laboratory tasks: Implications for management accounting. *Journal of Management Accounting Research* 12 (1): 19–64.

Bordalo, P., Gennaioli, N., & Shleifer, A. (2012). Salience theory of choice under risk. *The Quarterly Journal of Economics*, 127(3), 1243-1285.

Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. R. (2010). A basic introduction to fixed-effect and random-effects models for meta-analysis. *Research Synthesis Methods*, *1*(2), 97-111.

Borghi, J., Gorter, A., Sandiford, P., & Segura, Z. (2005). The cost-effectiveness of a competitive voucher scheme to reduce sexually transmitted infections in high-risk groups in Nicaragua. *Health Policy & Planning*, 20(4), 222-231.

Bosh-Capblanch, X., Abba, K., Prictor, M., & Garner, P. (2008). Contracts between patients and healthcare practitioners for improving patients' adherence to treatment, prevention and health promotion activities. *Cochrane Database of Systematic Reviews*, issue 2, 64 pages.

Bouchery, E. E., Harwood, H. J., Sacks, J. J., Simon, C. J., & Brewer, R. D. (2011). Economic costs of excessive alcohol consumption in the US, 2006. *American journal of preventive medicine*, *41*(5), 516-524.

Bowles, S. (2008a). Policies designed for self-interested citizens may undermine the moral sentiments: Evidence from economic experiments. *Science*, *320*(5883), 1605-1609.

Bowles, S., & Hwang, S. H. (2008b). Social preferences and public economics: Mechanism design when social preferences depend on incentives. *Journal of Public Economics*, *92*(8), 1811-1820.

Bowles, S., & Polania-Reyes, S. (2012). Economic incentives and social preferences: substitutes or complements? *Journal of Economic Literature*, *50*(2), 368-425.

Braveman, P. & Gruskin, S. (2003). Defining equity in health. *Journal of Epidemiology and Community Health*, 57, 254-258.

Breen, N., Wagener, D. K., Brown, M. L., Davis, W. W., & Ballard-Barbash, R. (2001). Progress in cancer screening over a decade: results of cancer screening from

the 1987, 1992, and 1998 National Health Interview Surveys. *Journal of the National Cancer Institute*, *93*(22), 1704-1713.

Brenner L., Rottenstreich Y., Sood S., Bilgin B. (2007). On the psychology of loss aversion: possession, valence, and reversals of the endowment effect. *Journal of Consumer Research,* 34, 369–376.

Brook, H., Ware, J., Rogers, W., Keeler, E., Davies, A., Donald, C., Goldberg, G., Lohr, K., Masthay, P., & Newhouse, J. (1983). Does free care improve adults' health? Results from a randomized controlled trial. *The New England Journal of Medicine*, 309, 1426-1434.

Brown B, & Promberger M. (2011). The NHS 'should pay' patients to become healthy BBC Viewpoint http://www.bbc.co.uk/news/health-12180526

Brown, K. Kroll, J., Hudson, M., Ramsay, M., Green, J., Long, S., Vicent, C., Fraser, G., & Sevdalis,, N. (2010). Factors underlying parental decisions about combination childhood vaccinations including MMR: A systematic review. *Vaccine*, 28, 4235-4248.

Brownson, R. C., Baker, E. A., Left, T. L., Gillespie, K. N., & True, W. R. (2011). *Evidence-based public health*. UK: OUP.

Brunner, D. (1999). Preference for sequence of rewards: Further tests of a parallel discounting model. *Behavioural Processes*, 45, 87-99.

Bryan, G., Karlan, D., & Nelson, S. (2010). Commitment devices. *Annual Review of Economics*, *2*(1), 671-698.

Burack, R., Gimotty, P., George, J., Stengle, W., Warbasse, L., & Moncrease, A. (1994). Promoting screening mammography in inner-city settings: A randomized controlled trial of computerized remainders as a component of a program to facilitate mammography. *Medical Care*, 32(6), 609-624.

Burger, J. & Caldwell, D. (2003). The effects of monetary incentives and labeling on the foot-in-the-door effect: Evidence for a self-perception process. *Basic and Applied Psychology*, 25(3), 235-241.

Burns, T. (2007). Is it acceptable for people to be paid to adhere to medication? Yes. *BMJ*, 335, 232-233.

Busby, H., Kent, J., & Farrell, A. M. (2013). Re-valuing donor and recipient bodies in the globalised blood economy: Transitions in public policy on blood safety in the UK. *Health: An Interdisciplinary journal for the social study of health and illness*.

Buyx, A. M. (2009). Blood donation, payment, and non-cash incentives: classical questions drawing renewed interest. *Transfusion Medicine and Hemotherapy*, *36*(5), 329-339.

Camerer, C. F., Loewenstein, G. & Rabin, M. (2004). *Advances in behavioral economics*, NY: Princeton University Press.

Cameron, J. and W. D. Pierce. (1994). Reinforcement, reward, and intrinsic motivation: a meta-analysis. *Review of Educational Research* 64 (3): 363-423.

Cameron, J., K. M. Banko, and W. D. Pierce. (2001). Pervasive negative effects of rewards on intrinsic motivation: The myth continues. *The Behavior Analyst* 24 (1): 1-44.

Campbell MK, Elbourne DR, Altman DG. CONSORT statement: extension to cluster randomised trials. Bmj 2004;328(7441):702-08

Campbell, N., Boustani, M., Skopelja, E., Gao, S., Unverzagt, F., & Murray, M. (2012). Medication adherence in older adults with cognitive impairment: A systematic evidence-based review. *The American Journal of Geriatric Pharmacotheraphy*, 10(3), 165-177.

Caplin, A., & Leahy, J. (2001). Psychological expected utility theory and anticipatory feelings. *The Quarterly Journal of Economics*, *116*(1), 55-79.

Carton, J., & Schweitzer, J. (1996). Use of a token economy to increase compliance during hemodialysis. *Journal of Applied Behavior Analysis*, 29, 111-113.

Case, A., Roux, I., & Menendez, A. (2004). Medical compliance and income-health gradients. *American Economic Review*, 94(2), 331-335.

Carlsen, K. H., Carlsen, K. M., & Serup, J. (2011). Non-attendance rate in a Danish University Clinic of Dermatology. *Journal of the European Academy of Dermatology and Venereology*, *25*(11), 1269-1274.

Chaiken, S., & Trope, Y. (1999). *Dual-Process Theories in Social Psychology*. NY: The Guilford Press

Chan (2003). Randomised controlled trials (RCTs) – sample size: The magic number? *Singapore Medical Journal*, 44(4), 172-174.

Chandon, P., Smith, R. J., Morwitz, V. G., Spangenberg, E. R., & Sprott, D. E. (2011). When does the past repeat itself? The interplay of behavior prediction and personal norms. *Journal of Consumer Research*, *38*(3), 420-430.

Chapman, G. B. (2000). Preferences for improving and declining sequences of health outcomes. *Journal of Behavioral Decision Making*, *13*(2), 203-218.

Chapple, A., Ziebland, S., Hewitson, P., & McPherson, A. (2008). What affects the uptake of screening for bowel cancer using a faecal occult blood test (FOBt): A qualitative study. *Social Science & Medicine*, 66, 2425-2435.

Charness, G., & Gneezy, U. (2009). Incentives to exercise. *Econometrica*, *77*(3), 909-931.

Chmielewski, D., Bove, L. L., Lei, J., Neville, B., & Nagpal, A. (2012). A new perspective on the incentive–blood donation relationship: partnership, congruency, and affirmation of competence, *Transfusion*.

Claassen, D., Fakhoury, W. K., Ford, R., & Priebe, S. (2007). Money for medication: financial incentives to improve medication adherence in assertive outreach. *Psychiatric Bulletin*, *31*(1), 4-7.

Claxton, A., Cramer, J., & Pierce, C. (2001). A systematic review of the associations between dose regimens and medication compliance. *Clinical Therapeutics*, 23(8), 1296-1310.

Cleemput, I., Kesteloot, K., & DeGeest, S. (2002). A review of the literature on the economics of noncompliance: Room for methodological improvement. *Health Policy*, 59, 65-94.

Cohen, M., & Jaffary, J. (1988). Certainty Effect Versus Probability Distortion: An Experimental Analysis of Decision Making Under Risk. *Journal of Experimental Psychology: Human Perception and Performance*, 14(4), 554-560.

Cole, J., Norman, H., Weatherby, L., Walker, A. (2006). Drug copayment and adherence in chronic heart failure: effect on cost and outcomes. *Pharmacotherapy*, 26(8), 1157-1164.

Conaway, M., Rejeski, W., & Miller, M. (2009). Statistical issues in measuring adherence: Methods for incomplete longitudinal data. In S. Shumaker, J., Ockene, & K. Riekert (Eds.), *The Handbook of Health Behavior Change*, 375-392. NY: Springer Publishing.

Conner, M., Godin, G., Sheeran, P., & Germain, M. (2013). Some feelings are more important: Cognitive attitudes, affective attitudes, anticipated affect, and blood donation. *Health Psychology*, *32*(3), 264.

Cook, R., Ostergaard, L., Hilier, S., Murray, P., Chang C., Comer, D., & Ness, R. (2007). Home screening for sexually transmitted diseases in high-risk young

women: Randomised controlled trial. *Sexually Transmitted Infections*, 83, 286-291.

Cooke, L. J., Chambers, L. C., Añez, E. V., Croker, H. A., Boniface, D., Yeomans, M. R., & Wardle, J. (2011). Eating for Pleasure or Profit the Effect of Incentives on Children's Enjoyment of Vegetables. *Psychological science*, *22*(2), 190-196.

Cooper, A. & Gomez, R. (2008). The development of a short form of the sensitivity to punishment and sensitivity to reward questionnaire. *Journal of Individual Differences*, 29(2), 90-104.

Cooper, M. H., & Culyer, A. J. (1968). *The price of blood: an economic study of the charitable and commercial principle*. London: Institute of Economic Affairs.

Cooper, P. & Vistnes, J. (2003). Workers' Decisions to Take-Up Offered Health Insurance Coverage: Assessing the Importance of Out-of-Pocket Premium Costs. *Medical Care*, 41(7), 35-43.

Cooper, Z., Gibbons, S., Jones, S., & McGuire, A. (2011). Does hospital competition save lives? evidence from the English NHS patient choice reforms*. *The Economic Journal*, *121*(554), F228-F260.

Costa-Font, J., Jofre-Bonet, M., & Yen, S. T. (2013). Not All Incentives Wash Out the Warm Glow: The Case of Blood Donation Revisited. *Kyklos*, *66*(4), 529-551.

Cramer, J. (2004). A Systematic review of adherence with medications for diabetes. *Diabetes Care*, 27(5), 218-225.

Cramer, J., Roy, A. Burrell, A., Fairchild, C., Fuldeore, M., Ollendorf, D., & Wong, P. (2008). Medication compliance and persistence: Terminology and definitions. *Value in Health*, 11(1), 44-47.

Crawford, I. (2010). Habits revealed. *The Review of Economic Studies*, *77*(4), 1382-1402.

Crumm, E. (1995). The value of economic incentives in international Politics. *Journal of Peace Research,* 32(3), 313-330.

Cunningham, D., Atkin, W., Lenz, H., Lynch, H., Minsky,B., Nordlinger, B., Starling, M., (2010). Colorectal cancer. The Lancet, 375 (9719), 1030-1047.

Dahl, D., Gorn, G., & Weinberg, C. (1999). Encouraging use of coupons to stimulate condom purchase. *American Journal of Public Health*, 89(12), 1866-1869.

Dalton, A. R., Bottle, A., Okoro, C., Majeed, A., & Millett, C. (2011). Uptake of the NHS Health Checks programme in a deprived, culturally diverse setting: cross-sectional study. *Journal of Public Health*, *33*(3), 422-429.

Dapcich-Mura, E., & Hovell, M. (1979). Contingency management of adherence to a complex medical regimen in an elderly heart patient. *Behavior Theraphy*, 10, 193-201.

Daugherty, J. R., & Brase, G. L. (2010). Taking time to be healthy: Predicting health behaviors with delay discounting and time perspective. *Personality and Individual Differences*, *48*(2), 202-207.

De Brauw, A., & Hoddinott, J. (2011). Must conditional cash transfer programs be conditioned to be effective? The impact of conditioning transfers on school enrolment in Mexico. *Journal of Development Economics*, 96(2), 359-370.

De Costa, A., Patil, R., Kushwah, S., & Diwan, V. (2009). Financial incentives to influence maternal mortality in a low-income setting: Making available 'money to transport' - experiences from Amarpatan, India. *Global Health Action*, 2, 9 pages.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology* 18 (1): 105-115.

Deci, E. L. (1972). Intrinsic motivation, extrinsic reinforcement and inequity. *Journal of Personality and Social Psychology* 22 (1): 113-120.

Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum Publishing Co

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Publishing Co.

Deci, E. L., & Ryan, R. M. (2012. *The Oxford Handbook of Human Motivation.* Oxford: OUP.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627-668.

DellaVigna, S. (2009). Psychology and Economics: Evidence from the Field. *Journal of Economic Literature*, *47*(2), 315-372.

Deren, S., Stephens, R., Davis, W. R., Feucht, T. E., & Tortu, S. (1994). The impact of providing incentives for attendance at AIDS prevention sessions. *Public health reports*, *109*(4), 548.

Diaz, J. A., & Slomka, T. (2012). Colorectal cancer screening. *American journal of lifestyle medicine*, *6*(3), 196-203.

DiMatteo, R. (2004a). Variations in patients' adherence to medical recommendations. *Medical Care*, 42(3), 200-209.

DiMatteo, R. (2004b). Social support and patient adherence to medical treatment: a meta-analysis. *Health Psychology*, 23(2), 207-218.

DiMatteo, R., Lepper, H., & Croghan, T. (2000). Depression is a risk factor for noncompliance with medical treatment. Archives of Internal Medicine, 160, 2101-2107.

DiMatteo, R., Giordani, P., Lepper, H., & Croghan, T. (2002). Patient adherence and medical treatment outcomes: A meta-analysis. *Medical Care*, 40(9), 794-811.

DiMatteo, R., Haskard-Zolnierel, K., & Martin, L. (2012). Improving patient adherence: A three-factor model to guide practice. *Health Psychology Review*, 6(1), 74-91.

Dinsmoor, James A. (2004). The etymology of basic concepts in the experimental analysis of behavior. *Journal of the Experimental Analysis of Behavior*, 82 (3): 311-316.

Dixon, A., LeGrand, J., Henderson, J., Murray, R., & Poteliakhoff, E. (2007). Is the British National Health Service equitable? The evidence on socioeconomic differences in utilization. *Journal of Health Services Research & Policy*, 12(2), 104-109.

Dolan, P., & Kahneman, D. (2008). Interpretations of Utility and Their Implications for the Valuation of Health. *The Economic Journal*, *118*(525), 215-234.

Dolan, P., Hallsworth, M., Halpern, D., King, D., & Vlaev, I. (2010). *MINDSPACE: Influencing behaviour through public policy*. London, UK: Cabinet Office & Institute for Government.

Dolan; P. & Rudisill, A. (forthcoming). The effect of financial incentives to increase Chlamydia screening. Unpublished paper, London School of Economics.

Domen, R. E. (1995). Paid-versus-volunteer blood donation in the united states: A historical review. *Transfusion Medicine Reviews, 9*(1), 53-59.

Donner, A., & Klar, N. (2002). Issues in the meta-analysis of cluster randomized trials. *Statistics in Medicine*, 21, 2971–2980.

Doran, T., Fullwood, C., Kontopantelis, E., & Reeves, D. (2008). Effect of financial incentives on inequalities in the delivery of primary clinical care in England:

analysis of clinical activity indicators for the quality and outcomes framework. *The Lancet*, *372*(9640), 728-736.

Duffy, S., & Smith, J. (2013). Preference for increasing wages: How do people value various streams of income?. *Judgment and Decision Making*, *8*(1), 74-90.

Duflo, E., Hanna, R., & Rya, S. P. (2012). Incentives work: Getting teachers to come to school. *The American Economic Review*, *102*(4), 1241-1278.

Dunbar-Jacob, J., Gemmel, L., & Schlenk, E. (2009). Predictors of patient adherence: Patient Characteristics. In S. Shumaker, J., Ockene, & K. Riekert (Eds.), *The Handbook of Health Behavior Change*, 411-426. NY: Springer Publishing.

Duncan, B., Hart, G., Scoular, A., and Bigrigg, A. (2001). Qualitative analysis of psychosocial impact of diagnosis of Chlamydia Trachomatis: Implications for screening. *BMJ*, 27, 195-199.

Dusheiko, M., Gravelle, H., Jacobs, R., & Smith, P. (2006). The effect of financial incentives on gatekeeping doctors: evidence from a natural experiment. *Journal of Health Economics*, *25*(3), 449-478.

Eaddy, M. T., Cook, C. L., O'Day, K., Burch, S. P., & Cantrell, C. R. (2012). How patient cost-sharing trends affect adherence and outcomes: a literature review. *Pharmacy and Therapeutics*, *37*(1), 45.

Eastlund, T. (1998). Monetary blood donation incentives and the risk of transfusion-transmitted infection. *Transfusion, 38*(9), 874-882.

Eijkenaar, F., Emmert, M., Scheppach, M., & Schöffski, O. (2013). Effects of pay for performance in health care: A systematic review of systematic reviews. *Health Policy* (in press)

Eisenberg, R. and J. Cameron. 1996. Detrimental effects of reward: Reality or myth? *American Psychologist* 51 (11): 1153-1166.

Elliott RA, Barber N, & Horne R (2005). Cost-Effectiveness of Adherence-Enhancing Interventions: A Quality Assessment of the evidence. *The Annals of Pharmacotherapy*, 39, 508-515.

Elliot, R., Shinogle, J., Peele, P., Bhosle, M., & Hughes, D. (2008). Understanding medication compliance and persistence from an economics perspective. *Value in Health*, 10 pages.

Etchart-Vincent, N., & l'Haridon, O. (2011). Monetary incentives in the loss domain and behavior toward risk: An experimental comparison of three reward schemes including real losses. *Journal of Risk and Uncertainty*, *42*(1), 61-83.

Fairbrother, G., Siegel, M., Friedman, S., Kory, P., & Butts, G. (2001). Impact of Financial Incentives on Documented Immunization Rates in the Inner City: Results of a Randomized Controlled Trial. *Ambulatory Pediatrics*, 1(4), 206-212.

Falk, A., & Kosfeld, M. (2006). The Hidden Costs of Control. *American Economic Review*, *96*(5), 1611-1630.

Fehr, E. and S. Gatcher. (2000). Fairness and retaliation: The economics of reciprocity. *The Journal of Economic Perspectives* 14 (3): 159-181.

Fehr, E. & Falk, A. (2002). Psychological foundations of incentives. European Economic Review, 46, 687-724

Fehr, E. & Rockenbach, B. (2003). Detrimental Effects of Sanctions on Human Altruism. *Nature,* 422, 137-140.

Fehr, E. and J. A. List. (2004). The Hidden costs and returns of incentives—Trust and trustworthiness among CEOs. *Journal of the European Economic Association* 2 (5): 743-771.

Ferlay, J., Autier, P., Boniol, M., Heanue, M., Colombet, M., & Boyle, P. (2007). Estimates of the cancer incidence and mortality in Europe in 2006. *Annals of oncology*, *18*(3), 581-592.

Ferrari, J. R., Barone, R. C., Jason, L. A., & Rose, T. (1985). The Use of Incentives to Increase Blood Donations. *The Journal of Social Psychology, 125*(6), 791-793.

Finkelstein, A., Taubman, S., Wright, B., Bernstein, M., Gruber, J., Newhouse, J. P. & Baicker, K. (2012). The Oregon Health Insurance Experiment: Evidence from the First Year. *The Quarterly Journal of Economics*, *127*(3), 1057-1106.

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: payer-and service-specific estimates. *Health affairs*, *28*(5), w822-w831.

Fleischhacker, W., Meise, U., Günther, V., & Kurz, M. (1994). Compliance with antipsychotic drug treatment: influence of side effects. *Acta Psychiatrica Scandinavica*, 89(382), 11 – 15**.**

Fox, M., & Phua, K. (1995). Do increases in payment for obstetrical deliveries affect prenatal care. *Public Health Reports*, 110(3), 319-326.

Fox, M., Weiner, J., & Phua, K. (1992). Effect of Medicaid payment levels on access to obstetrical care. Health Affairs, 150-161.

France, C. R., France, J. L., Wissel, M. E., Kowalsky, J. M., Bolinger, E. M., & Huckins, J. L. (2011). Enhancing blood donation intentions using multimedia donor education materials. *Transfusion*, *51*(8), 1796-1801.

Frazier, A., Colditz, G., Fuchs, C., & Kuntz, K. (2000). Cost-effectiveness of screening for colorectal cancer in the general population. *JAMA*, 284(15), 1954-1961.

Frederick, S., Loewenstein, G. & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature*, XL, 351-401.

Frey, B. S. (1994). How intrinsic motivation is crowded out and in. *Rationality and Society* 6 (3): 334-352.

Frey, B. S. (1997). *Not Just for the Money: An Economic Theory of Personal Motivation*. Cheltenham, UK/Brookfield, USA: Edward Elgar.

Frey, B. S. (2006). Giving and receiving awards. *Perspectives on Psychological Science* 1 (4): 377-388.

Frey, B. S. (2007). Awards as compensation. *European Management Review* 4 (1): 6-14.

Frey, B. & Oberholzer-Gee, F. (1997). The cost of price incentives: An empirical analysis of motivation crowding-out. *The American Economic Review*, 87(4), 746-754.

Frey, B. & Jegen, R. (2001). Motivation Crowding-out Theory. *Journal of Economic Surveys*, 15(5), 589-611.

Fylan, F. (1998). Screening for cervical cancer: A review of women's attitudes, knowledge and behaviour. *British Journal of General Practice*, 48, 1509-1514.

Gallagher, K., & Updegraff, J. (2012). Health Message Framing Effects on Attitudes, Intentions, and Behavior: A Meta-analytic Review. *Annals of Behavioral Medicine*, 43(1), 101-116.

Galizzi, M. M. (2012). Label, nudge or tax? A review of health policies for risky behaviours. *Journal of Public Health*, *1*, e5.

Gannon, M., & Dowling, M. (2008). Increasing the uptake of cervical screening programmes. *British Journal of Nursing*, *17*(20), 1280-1284.

Garavan, H., & Weierstall, K. (2012). The neurobiology of reward and cognitive control systems and their role in incentivizing health behavior. *Preventive Medicine*, 55(1), 17-23.

Gardner, B., & Lally, P. (2012). Does intrinsic motivation strengthen physical activity habit? Modeling relationships between self-determination, past behaviour, and habit strength. *Journal of Behavioral Medicine*, 1-10.

Gerend, M. A., Shepherd, M. A., & Shepherd, J. E. (2013). The multidimensional nature of perceived barriers: Global versus practical barriers to HPV vaccination. *Health Psychology*, *32*(4), 361.

Gertler, P. (2004). Do conditional cash transfers improve child health? Evidence from PROGRESA's control randomized experiment. *The American Economic Review*, *94*(2), 336-341.

Gessous, I., Dash, C., Lapin, P., Doroshenk, M., Smith, R., & Klabunde, C. (2010). Colorectal cancer screening barriers and facilitators in older persons. *Preventive Medicine*, 50, 3-10.

Giacomini, M., Hurley, J., Lomas, J., Bhatia, V., & Goldsmith, L. (1996). *The Many Meanings of Money: A Health Policy Analysis Framework for Understanding Financial Incentives*. McMaster University, Centre for Health Economics and Policy Analysis Working Paper 96-6.

Gibson, T., Ozminkowski, R., & Goetzel, R. (2005). The effects of prescription drug cost sharing: A review of the evidence. *The American Journal of Managed Care*, 11(11), 730-740.

Gift, T. L., Malotte, C. K., Ledsky, R., Hogben, M., Middlestadt, S., VanDevanter, N. L., & Lawrence, J. S. S. (2005). A cost-effectiveness analysis of interventions to increase repeat testing in patients treated for gonorrhea or chlamydia at public sexually transmitted disease clinics. *Sexually transmitted diseases*, *32*(9), 542-549.

Gigerenzer, G. (2008). Why heuristics work. *Perspectives on Psychological Science*, *3*(1), 20-29.

Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual review of psychology*, *62*, 451-482.

Gigerenzer, G., & Galesic, M. (2012). Why do single event probabilities confuse patients? *BMJ*, *344*.

Gillam, S. J., Siriwardena, A. N., & Steel, N. (2012). Pay-for-performance in the United Kingdom: impact of the Quality and Outcomes Framework—a systematic review. *The Annals of Family Medicine*, *10*(5), 461-468.

Giné, X., Karlan, D., & Zinman, J. (2010). Put your money where your butt is: a commitment contract for smoking cessation. *American Economic Journal: Applied Economics*, 213-235.

Ginige S, Fairley CK, Hocking JS, Bowden FJ, Chen MY (2007). Interventions for increasing chlamydia screening in primary care: a review. BMC Public Health, 7(1), 95.

Giuffrida & Torgerson (1997). Should we pay the patient? Review of financial incentives to enhance patient compliance. *BMJ*, 315, 703-707.

Glynn, S. A., Williams, A. E., Nass, C. C., Bethel, J., Kessler, D., Scott, E. P., & Schreiber, G. B. (2003). Attitudes toward blood donation incentives in the United States: implications for donor recruitment. *Transfusion*, *43*(1), 7-16.

Gneezy, U. & Rustichini, A. (2000). Pay Enough or Don't Pay at All. *Quarterly Journal of Economics,* 115(2), 791-810.

Gneezy, U., Meier, S., & Rey-Biel, P. (2011). When and why incentives (don't) work to modify behaviour. *Journal of Economic Perspectives*, 25(4), 1-21.

Gobin, M., Verlander, N., Maurici, C., Bone, A., & Nardone, A. (2013). Do sexual health campaigns work? An outcome evaluation of a media campaign to increase chlamydia testing among young people aged 15--24 in England. *BMC Public Health*, *13*(1), 484-504.

Godin, G., Vézina-Im, L.-A., Bélanger-Gravel, A., & Amireault, S. (2012). Efficacy of Interventions Promoting Blood Donation: A Systematic Review. *Transfusion Medicine Reviews, 26*(3), 224-237.e226.

Goette, L., & Stutzer, A. (2008). Blood donations and incentives: Evidence from a field experiment: University of Zurich, IZA Working Paper No 3580.

Goette, L., Stutzer, A., & Frey, B. M. (2010). Prosocial Motivation and Blood Donations: A Survey of the Empirical Literature. *Transfusion Medicine and Hemotherapy, 37*(3), 149-154.

Goette, L., Stutzer, A., Yavuzcan, G., & Frey, B. M. (2009). Free cholesterol testing as a motivation device in blood donations: evidence from field experiments. *Transfusion, 49*(3), 524-531.

Goff, S., Mazor, K., Meterko, V., Dodd, K., & Sabin, J. (2008). Patients' beliefs and preferences regarding doctors' medication recommendations. *Journal of General Internal Medicine*, 23(3), 236–241.

Goldsmith, K., & Dhar, R. (2013). Negativity Bias and Task Motivation: Testing the Effectiveness of Positively Versus Negatively Framed Incentives. Journal of Experimental Psychology: Applied, 9 pages, online first.

Gomel, M., Oldenburg, B., Simpson, J., & Owen, N. (1993). Work-site cardiovascular risk reduction: A randomized trial of health risk assessment, education, couseling and incentives. *American Journal of Public Health*, 83(9), 1231-1238.

Grady, K., Lemkau, J., Lee, N., & Caddell, C. (1997). Enhancing mammography referral in primary care. *Preventive Medicine*, 26(6), 791-800.

Green, S. (2002). Design of randomized trials. *Epidemiologic Reviews*, 24(1), 4-11.

Grosset, K., Bone, I., & Grosset, D. (2006). Measuring theraphy adherence in Parkinson's disease: A comparison of methods. *Journal of Neurology, Neurosurgery and Psychiatry*, 77, 249-251.

Guy, R., Ali, H., Liu, B. Poznanski**, S.,** Ward, J., Donovan, B., Kaldor, J., and Hocking, J. (2011). Efficacy of interventions to increase the uptake of chlamydia screening in primary care: a systematic review. *BMC Infectious Diseases*, 11, 211-224.

Haisley, E., Volpp, K., Pellathy, T., & Loewenstein, G. (2012). The Impact of Alternative Incentive Schemes on Completion of Health Risk Assessments. *American Journal of Health Promotion*, 3, 184-188.

Happich, M. & Mazurek, B. (2002). Priorities and Prospect theory. *European Journal of Health Economics*, 3, 40-46.

Harinck, F., Van Dijk, E., Van Beest, I., & Mersmann, P. (2007). When gains loom larger than losses reversed loss aversion for small amounts of money. *Psychological Science*, *18*(12), 1099-1105.

Harrison, G. W., & Rutström, E. E. (2009). Expected utility theory and prospect theory: One wedding and a decent funeral. *Experimental Economics*, *12*(2), 133-158.

Harrison, G. W., & List, J. A. (2004). Field experiments. *Journal of Economic Literature*, 1009-1055.

Hartford, T. (2011). *The Undercover Economist*. New York: Random House.

Haskard, K., DiMatteo, M., & Williams, S. (2009). Adherence and health outcomes: How much does adherence matter? In S. Shumaker, J., Ockene, & K. Riekert (Eds.), *The Handbook of Health Behavior Change*, 771-784. NY: Springer Publishing.

Hastings, J., & Shapiro, J. M. (2012). *Mental Accounting and Consumer Choice: Evidence from Commodity Price Shocks* (No. w18248). National Bureau of Economic Research.

Haynes, R., Gibson, E., Hackett, B., Sackett, D., Taylor, D., Roberts, R., & Johnson, A. (1976). Improvement of medication compliance in uncontrolled hypertension. *The Lancet*, 307 (7972), 1265-1268.

Haynes, R., McDonald, H., & Montague, P. (2002). Interventions for helping patients to follow prescriptions for medications. *The Cochrane Library*, issue 2, 43 pages.

Haynes, R. B., Ackloo, E., Sahota, N., McDonald, H. P., & Yao, X. (2008). Interventions for enhancing medication adherence. *Cochrane database syst Rev*, *2*(2).

Health Protection Agency (2009). The Bigger Picture: T*he National Chlamydia Screening Programme in England 2008/ 2009*. London: HPA.

Healy, K. J. (2006). *Last best gifts : altruism and the market for human blood and organs*. Chicago: University of Chicago Press.

Healy, K. J. (2006). *Last best gifts: altruism and the market for human blood and organs*. Chicago: University of Chicago Press.

Heap, S. P. H. (2013). What is the meaning of behavioural economics?. *Cambridge Journal of Economics*, 37(5), 985-1000.

Heath, C., Larrick, R., & Wu, G. (1999). Goals as reference points. *Cognitive Psychology*, 38, 79-109.

Heath, T. B., Chatterjee, S., & France, K. R. (1995). Mental accounting and changes in price: the frame dependence of reference dependence. *Journal of Consumer Research*, 90-97.

Hegel, M., Ayllon, T., Thiel, G., & Oulton, B. (1992). Improving adherence to fluid restrictions in male hemodialysis patients: A comparison of cognitive and behavioral approaches. *Health Psychology*, 11(5), 324-330.

Herrnstein, R. J. (1970). On the law of effect. *Journal of the Experimental Analysis of Behavior, 13*, 243-266.

Hewitson, P., Glasziou, P., Irwig, L., Towler, B., & Watson, E. (2007). Screening for colorectal cancer using the faecal occult blood test, Hemoccult. *Cochrane Database Syst Rev*, *1*.

Heyman, J., & Ariely, D. 2004. Effort for payment a tale of two markets. *Psychological Science*, *15*(11), 787-793.

Higgins, J., & Green, S. (Eds.). (2011). *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0*: The Cochrane Collaboration.

Higgins, S. T., Washio, Y., Heil, S. H., Solomon, L. J., Gaalema, D. E., Higgins, T. M., & Bernstein, I. M. (2012). Financial incentives for smoking cessation among pregnant and newly postpartum women. *Preventive medicine*, *55*, S33-S40.

Hill J., & Ramachandran G. (1992). A simple scheme to improve compliance in patients taking tuberculosis medication. *Tropical Doctor*, 22(4):161-3.

Hoekstra, E., LeBaron, C., & Johnson-Partlow, T. (1999). Does remainder-recall augment the impact of voucher incentives on immunization rates among inner-city infants enrolled in WIC*? Journal of Pediatrics*, 135(2), 261-263.

Hoelzl, E., Kamleitner, B., & Kirchler, E. (2011). Loan repayment plans as sequences of instalments. *Journal of Economic Psychology*, *32*(4), 621-631.

Holden, D. J., Jonas, D. E., Porterfield, D. S., Reuland, D., & Harris, R. (2010). Systematic review: enhancing the use and quality of colorectal cancer screening. *Annals of internal medicine*, *152*(10), 668-676.

Holland, C., Everitt, P., Johnson, A., & Devi, R. (2008). The 'Healthy Passport' intervention with older people in an English urban environment: Effects of incentives and peer-group organisers in promoting healthy living. *Ageing & Society*, 28, 525-549.

Hollmeyer, H. Hayden, F., Poland, G., & Buchholz, U. (2009). Influenza vaccination of health care workers in hospitals – a review of studies on attitudes and predictors. Vaccine, 27, 3935-3944.

Holly, C. D., Torbit, L., & Ditto, B. (2012). Applied tension and coping with blood donation: A randomized trial. *Annals of Behavioral Medicine*, *43*(2), 173-180.

Holmstrom, B. and P. Milgrom. (1991). Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design. *Journal of Law, Economics and Organization* 7:24-52.

Horne, R. (2006). Compliance, adherence and concordance. *Chest*, 130(1), 65-72.

Hossain, T., & List, J. A. (2012). The behavioralist visits the factory: Increasing productivity using simple framing manipulations. *Management Science*, *58*(12), 2151-2167.

Hsu, J., Price, M., Huang, J., Brand, R., Fung, V., Hui, R., Fireman, B., Newhouse, J., & Selby, J. (2006). Unintended consequences of caps on Medicare drug benefits. *The New England Journal of Medicine*, 354, 2349-2359.

Husten, C. G., & Deyton, L. R. (2013). Understanding the Tobacco Control Act: efforts by the US Food and Drug Administration to make tobacco-related morbidity and mortality part of the USA's past, not its future. *The Lancet*, *381*(9877), 1570-1580.

Hutchins,S., Rosenthal, J., Eason, P., Swint, E., Guerrero, H., & Hadler, S. (1999). Effectiveness and Cost-Effectiveness of Linking the Special Supplemental Program for Women, Infants, and Children (WIC) and Immunization Activities. *Journal of Public Health Policy*, 20(4), 408-426.

Hyde, R., & Brumfield, B. (2003). Effect of co-payment on the use of medical services by male and female prisoners. *Journal of Correctional Health Care*, 9(4), 371-380.

Iajya, V., Lacetera, N., Macis, M., & Slonim, R. (2013). The Effects of Information, Social and Financial Incentives on Voluntary Undirected Blood Donations: Evidence from a Field Experiment in Argentina. *Social Science & Medicine*, in press.

Institute of Alcohol Studies (2003). *Alcohol and tax.* St Ives: Institute of Alcohol Studies.

Isen, A. M. (2000). Positive affect and decision making. In M. Lewis & J. Haviland-Jones (Eds.), *Handbook of Emotions* (2nd ed.), 417-435. New York: Guilford Press.

Jain, S. H., & Rother, J. (2011). Are Patients Knights, Knaves, or Pawns?. *JAMA: The Journal of the American Medical Association*, *305*(20), 2112.

Jakubowiak, W., Bogorodskaya, E., Borisov, S., Danilova, I., Lomakina, O., & Kourbatova, E. (2007). Social support and incentives programme for patients with tuberculosis: Experience from the Russian Federation. *International Journal of Tuberculosis Lung Disease*, 11(11), 1210-1215.

Jarnebrant, P., Toubia, O., & Johnson, E. (2009). The silver lining effect: Formal analysis and experiments. *Management Science*, *55*(11), 1832-1841.

Jason, L. A., Jackson, K., & Obradovic, J. L. (1986). Behavioral Approaches in Increasing Blood Donations. *Evaluation and the Health Professions, 9*(4), 439-448.

Jeffrery, R., & French, S. (1999). Preventing weight gain in adults: The pound of prevention study. *American Journal of Public Health*, 89(5), 747-751.

Jenkins, W. D., Weis, R., Campbell, P., Barnes, M., Barnes, P., & Gaydos, C. (2012). Comparative effectiveness of two self-collected sample kit distribution systems for chlamydia screening on a university campus. *Sexually Transmitted Infections*, *88*(5), 363-367.

Jochelson K.(2006). Nanny or steward? The role of government in public health. *Public Health,* 120, 1149–1155.

Jochelson, K. (2007). *Paying the patient: Improving health using financial incentives.* London: Kings Fund.

John, L., Loewenstein, G., Troxel, A., Norton, L., Fassbender, J., & Volpp, K. (2011). Financial incentives for extended weight loss: A randomized, controlled trial. *Journal of General Internal Medicine*, 26(6), 621-626.

Kahana, S., Drotar, D., & Frazier, T. (2008). Meta-Analysis of Psychological Interventions to Promote Adherence to Treatment in Pediatric Chronic Health Conditions. *Journal of Pediatric Psychology*, 33(6), 590-611.

Kahneman, D. (2003a). Maps of Bounded Rationality: Psychology for Behavioral Economics. *American Economic Review*, 93(5), 1449-1475

Kahneman, D. (2003b). A Psychological Perspective on Economics. *American Economic Review*, 93(2), 162-168.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An Analysis of Decision under Risk. *Econometrica,* 47(2), 263-292.

Kahneman, D. & Wakker, P. & Sarin, R. (1997). Back to Bentham? Explorations of Experienced Utility. *The Quarterly Journal of Economics*, 112(2), 375-405.

Kahneman, D., & Tversky, A. (2000). *Choices, Values and Frames*. NY: Cambridge University Press & Russell Foundation.

Kalibatas, V. (2008). Payment for whole blood donations in Lithuania: the risk for infectious disease markers. *Vox Sanguinis, 94*(3), 209-215.

Kamb, M., Rhodes, F., Hoxworth, T., Rogers, J., Lentz, A., Kent, C., MacGowen, R., & Peterman, T. (1998). What about the money? Effect of small monetary incentives on enrolment, retention, and motivation to change behaviour in an HIV/ STD prevention counselling intervention. *Sexually Transmitted Infections*, 74, 253-255.

Kamenica, E. (2012). Behavioral economics and the psychology of incentives. *Annual Review of Economics*, 4, 427-452.

Kane, R., Johnson, P., Town, R., & Butler, M. (2004). A structured review of the effects of economic incentives on consumers' preventive behavior. *American Journal of Preventive Medicine*, 27(4), 327-352.

Kaplan, C., Bastani, R., Belin, T., Marcus, A., Nasseri, K. & Hu, M. (2000). Improving Follow-Up after an Abnormal Pap Smear: Results from a Quasi-Experimental Intervention Study. *Journal of Women's Health & Gender-Based Medicine*, 9(7), 779-790

Kazdin, A. E. (1982). The token economy: A decade later. *Journal of Applied Behavior Analysis*, *15*(3), 431-445

Keating, N., Zaslavsky, A., Goldstein, J., West, D., & Ayanian, J. (2008). Randomized trial of $20 versus $50 incentives to increase physician survey response rates. *Medical Care*, 46(8), 878-882.

Keen, Steve. 2011. *Debunking Economics: The Naked Emperor Dethroned?* (rev. and expanded edn). Zed Books, London and New York.

Keren, G., & Roelofsma, P. (1995). Immediacy and certainty in intertemporal choice. *Organizational Behavior and Human Decision Processes*, *63*(3), 287-297.

Kessels, R. (2003). Patients' memory for medical information. *Journal of the Royal Society of Medicine*, 96(5), 219-222.

Kiene SM, Barta WD, Zelenski JM, Lisa Cothran D. (2005). Why Are You Bringing Up Condoms Now? The Effect of Message Content on Framing Effects of Condom Use Messages. Health Psychology, 24(3):321-26

Kim, H. M. (2006). The effect of salience on mental accounting: How integration versus segregation of payment influences purchase decisions. *Journal of Behavioral Decision Making*, *19*(4), 381-391.

Kim, H., Shimojo, S., & O'Doherty, J. (2006). Is avoiding an aversive outcome rewarding? Neural substrates of avoidance learning in the human brain. *PLoS Biol*, 4(8): e233.

King, D., Greaves, F., Vlaev, I., & Darzi, A. (2013). Approaches Based On Behavioral Economics Could Help Nudge Patients And Providers Toward Lower Health Spending Growth. *Health Affairs*, *32*(4), 661-668.

Kleinsorge T, Rinkenauer G. Effects of monetary incentives on task switching. Experimental psychology 2012;59(4):216

Knetsch, J. L. & Wong, W. (2009). The endowment effect and the reference state: Evidence and manipulations. *Journal of Economic Behavior & Organization*, 71(2), 407-413.

Knutson, B., Adams, C. S., Fong, G. W. & Hommer, D. (2001). Anticipation of monetary reward selectively recruits nucleus accumbens. *Journal of Neuroscience*, 21, RC159

Knutson, B., Taylor, J., Kaufman, M., Peterson, R., & Glover, G. (2005). Distributed neural representation of expected value. *Journal of Neuroscience*, 25, 4806-4812.

Kohler, H. P., & Thornton, R. L. (2012). Conditional cash transfers and HIV/AIDS prevention: unconditionally promising?. *The World Bank Economic Review*, *26*(2), 165-190.

Kohn, A. (1999). *Punished by rewards: The trouble with gold stars, incentive plans, A's, praise and other bribes*. US: Mariner Books.

Kőszegi, B. (2003). Health anxiety and patient behavior. *Journal of health economics*, *22*(6), 1073-1084.

Kreps, D. M. (1997). Intrinsic Motivation and Extrinsic Incentives. *The American Economic Review, 87*(2), 359-364.

Kretschmer, V., Weippert-Kretschmer, M., Slonka, J., Karger, R., & Zeiler, T. (2004). Perspectives of Paid Whole Blood and Plasma Donation. *Transfusion Medicine and Hemotherapy, 31*(5), 301-307.

Kripalani, S., Yao, X., & Haynes, B. (2007). Interventions to enhance medication adherence in chronic medical conditions. *Archives of Internal Medicine*, 167, 540-550.

Lacetera, N., & Macis, M. (2010a). Do all material incentives for pro-social activities backfire? The response to cash and non-cash incentives for blood donations. *Journal of Economic Psychology, 31*(4), 738-748.

Lacetera, N., & Macis, M. (2010b). Social image concerns and prosocial behavior: Field evidence from a nonlinear incentive scheme. *Journal of Economic Behavior & Organization*, *76*(2), 225-237.

Lacetera, N., Macis, M., & Slonim, R. (2012). Will There Be Blood? Incentives and Displacement Effects in Pro-Social Behavior. *American Economic Journal: Economic Policy, 4*(1), 186-223.

Lacetera, N., Macis, M., & Slonim, R. (2013a). Economic Rewards to Motivate Blood Donations. *Science*, *340*(6135), 927-928.

Lacetera, N., & Macis, M. (2013b). Time for blood. The effect of paid leave legislation on altruistic behavior. *Journal of Law, Economics and Organization*, 29(4), 37 pages.

Laffont, J. J., & Martimort, D. (2009). *The theory of incentives: the principal-agent model*. Princeton University Press.

Lagrade, M., Haines, A., & Palmer, N. (2009). The impact of conditional cash transfers on health outcome and the use of health services in low and middle income countries. *Cochrane Database of Systematic Reviews*, Issue 4, 53 pages.

Lally, P., & Gardner, B. (2013). Promoting habit formation. *Health Psychology Review*, *7*(sup1), S137-S158.

Lally, P., Van Jaarsveld, C. H., Potts, H. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, *40*(6), 998-1009.

Lally, P., van Jaarsveld, C., Potts, H., Wardle, J. How are habits formed: Modelling habit formation in the real world. European Journal of Social Psychology, 2010, 40, 998-1009.Locke, E. (2004). Linking goals to monetary incentives. *Academy of Management Executive*, 18(4), 130-135.

Lamiraud, K. & Geoffard, P. (2007). Therapeutic non-adherence: A rational behaviour revealing patient preferences? *Health Economics*, 16, 1185-1204.

LaMontagne, D., Fenton, K., Randall, S., Anderson, S. & Carter, P. (2004). Establishing the National Chlamydia Screening Programme in England: results from the first full year of screening. *Sexually Transmitted Infections*, 80, 335-341.

Lancuck L, Patnick J, Vessey M. A cohort effect in cervical screening coverage? *J Med Screen* 2008, 15: 27-29.

Lawrence, G., MacInyre, C., & Hull, B. (2004). Effectiveness of the linkage of child care and maternity payments to childhood immunisation. *Vaccine*, 22, 2345–2350.

Lazear, E. P. (2000). Performance Pay and Productivity. *The American Economic Review* 90 (5): 1346-1361.

Le Grand, J. (2003). *Motivation, agency, and public policy: of knights and knaves, pawns and queens*. Oxford: OUP.

Lee, J., Schell, M., & Roetzheim, R. (2009). Analysis of group randomized trials with multiple binary points and small number of groups. *PloS One*, 4(10), 1-9.

Leicester, A. and Windmeijer, F. (2004) *The 'fat tax': economic incentives to reduce obesity*. IFS Briefing Notes (BN49). Institute for Fiscal Studies, London, UK.

Leontieva, L., Dimmonck, J., Gately, P., Gallinger, L, Ploutz-Snyder, R., & Batki, S. (2008). Voucher-based incentives for naltrexone treatment attendance is schizophrenia and alcohol use disorders. *Psychiatric Services*, 59(3), 310-314.

Lepper, M. R., D. Greene and R. E. Nisbet. (1973). Undermining children's intrinsic interest with extrinsic reward: a test of the "overjustification" hypothesis. *Journal of Personality and Social Psychology* 28 (1): 129-137.

Lepper, M.R. and D. Greene. (1978). *The hidden costs of reward: new perspectives on the psychology of human motivation*. New York: Erlbaum.

Levitt, S. and J. List. (2007). What Do Laboratory Experiments Measuring Social Preferences Reveal About the Real World? *Journal of Economic Perspectives* 21 (2): 153-174.

Levitt, S. and J. List. (2009). Field experiments in economics: The past, the present and the future. *European Economic Review* 53 (1): 1-18.

Lewin, S. B. (1996). Economics and psychology: Lessons for our own day from the early twentieth century. *Journal of Economic Literature*, *34*(3), 1293-1323.

Linville, P. W., & Fischer, G. W. (1991). Preferences for separating or combining events. *Journal of personality and social psychology*, *60*(1), 5.

List, J. A., & Gallet, C. A. (2001). What experimental protocol influence disparities between actual and hypothetical stated values?. *Environmental and Resource Economics*, *20*(3), 241-254.

Loevinsohn, B., & Loevinsohn, M. (1987). Well child clinics and mass vaccination campaigns: An evaluation of strategies for improving the coverage of primary health care in a developing country. *American Journal of Public Health*, 77(11), 1407-1411.

Loewenstein, G. (1987). Anticipation and the valuation of delayed consumption. *The Economic Journal*, *97*(387), 666-684.

Loewenstein, G., & Prelec, D. (1991). Negative time preference. *The American Economic Review*, *81*(2), 347-352.

Loewenstein, G., & Sicherman, N. (1991). Do workers prefer increasing wage profiles?. *Journal of Labor Economics*, 67-84.

Loewenstein, G. & Prelec, D. (1993). Preferences for sequences of outcomes. *Psychological Review, 100(1)*, 91-108.

Loewenstein, G., O'Donoghue, T. & Rabin, M. (2003). Projection bias in predicting future utility. *Quarterly Journal of Economics, 118*, 1209-1248

Lorvick, J., Thompson, S., Edlin, B., Kral, A., Lifson, A., & Watters, J. (1999). Incentives and accessibility: A pilot study to promote adherence to TB prophylaxis in a high-risk community. *Journal of Urban Health*, 76(4), 461-467.

Low, N., Cassell, J. A., Spencer, B., Bender, N., Hilber, A. M., van Bergen, J., & Stephenson, J. M. (2012). Chlamydia control activities in Europe: cross-sectional survey. *The European Journal of Public Health*, *22*(4), 556-561.

Low, N., Geisler, W., Stephenson, J., and Hook, E. (2013). Chlamydia Control: A Comparative Review from the USA and UK. In Aral, S., Fenton, K., and Lipshutz, J. (Eds.), *The New Public Health and STD/HIV Prevention*, 401-429.

Lurie, N., Manning, W., Peterson, C., Goldberg, G., Phelps, C., Lillard, L. (1987). Preventive care: Do we practice what we preach? *American Journal of Public Health*, 77(7), 801-804.

Lussier, J. P., Heil, S. H., Mongeon, J. A., Badger, G. J., & Higgins, S. T. (2006). A meta-analysis of voucher-based reinforcement therapy for substance use disorders. *Addiction*, *101*(2), 192-203.

MacDonald, H., Garg, A., & Haynes, R. (2002). Interventions to enhance patient adherence to medication prescriptions. *JAMA*, 288(22), 2868-2879.

MacKillop, J., Amlung, M. T., Few, L. R., Ray, L. A., Sweet, L. H., & Munafò, M. R. (2011). Delayed reward discounting and addictive behavior: a meta-analysis. *Psychopharmacology*, *216*(3), 305-321.

MacLaughlin, E., Raehl, C., Treadway, A., Streling, T., Zoller, D., & Bond, C. (2005). Assessing medication adherence in the elderly. *Drugs Aging*, 22(3), 1170-1229.

Madhavan, P., Lacson, F. C., Gonzalez, C., & Brennan, P. C. (2012). The Role of Incentive Framing on Training and Transfer of Learning in a Visual Threat Detection Task. *Applied Cognitive Psychology*, *26*(2), 194-206.

Magoon, M. A., & Critchfield, T. S. (2008). Concurrent schedules of positive and negative reinforcement: differential-impact and differential-outcomes hypotheses. *Journal of the experimental analysis of behavior*, *90*(1), 1-22.

Mandler, M. (1999). *Dilemmas in Economic Theory: Persisting fundamental problems in Microeconomics*. NY: Oxford University Press.

Mangura, B., Passannante, M, & Reichman,L. (1997). An incentive in tuberculosis preventive theraphy for an inner city population. *International Journal of Tuberculosis Lung Disease*, 1(6), 576-578.

Marteau, T., Ashcroft, R., & Oliver A. (2009). Using financial incentives to achieve health behaviour *BMJ*, 338, b1415.

Marteau, T. M., Ogilvie, D., Roland, M., Suhrcke, M., & Kelly, M. P. (2011). Judging nudging: can nudging improve population health?. *BMJ*, *342*.

Martin, G. & Pear, J. (2007). *Behavior modification: What it is and how to do it* (Eighth Edition). Upper Saddle River, NJ: Pearson Prentice Hall.

Martin, L., Williams, S., Haskard, K., & DiMatteo, R. (2005). The challenge of patient adherence. *Therapeutics and Clinical Risk Management*, 1(3), 189-199.

Martin, S. J., Currie, M. J., Deeks, L. S., Cooper, G. M., Parker, R. M., Del Rosario, R., & Bowden, F. J. (2012). P75 Do cash incentives increase the uptake of chlamydia testing in pharmacies? *Sexually Transmitted Infections*, *88*(Suppl 1), A35-A35.

Martin, S. J., Currie, M. J., Deeks, L. S., Cooper, G. M., Parker, R. M., Del Rosario, R., & Bowden, F. J. (2012). Do cash incentives increase the uptake of chlamydia testing in pharmacies?. *Sexually Transmitted Infections*, *88*(Suppl 1), A35-A35.

Martins, N., Morris, P., Kelly, P. (2009). Food incentives to improve completion of tuberculosis treatment: Randomised controlled trial in Dili, Timor-Leste. *BMJ*, 339, 8 pages.

Masser, B. M., White, K. M., Hyde, M. K., & Terry, D. J. (2008). The psychology of blood donation: current research and future directions. *Transfusion medicine reviews*, *22*(3), 215-233.

Mather, M., Mazar, N., Gorlick, M. A., Lighthall, N. R., Burgeno, J., Schoeke, A., & Ariely, D. (2012). Risk preferences and aging: The “certainty effect” in older adults' decision making. *Psychology and aging*, *27*(4), 801.

Mayer J A, Clapp E J, & Bartholomew S. (1994). Facility-based inreach strategies to promote annual mammograms. *American Journal of Preventive Medicine*, 10(6), 353–356.

McCormick, M., & McElroy, T. (2009). Healthy choices in context: How contextual cues can influence the persuasiveness of framed health messages. *Judgment and Decision Making, 4,* 248-255.

McIntyre, P., Gorter, A., Segura, Z., Savelkoul, P., & Morre, S. (2006). Chlamydia trachomatis infections in Nicaragua: Preliminary results from a competitive voucher scheme to prevent and treat sexually transmitted infections and HIV/AIDS among sex workers. *Drugs Today*, 42 (Suppl. A), 47.

Meissner, B., Moore, M., Shinogle, J., Reeder, C., & Little, J. (2004). Effects of an increase in prescription copayment on utilization of low-sedating antihistamines and nasal steroids. *Journal of Managed Care Pharmacy*, 10(3), 226-232.

Meissner, H. I., Klabunde, C. N., Breen, N., & Zapka, J. M. (2012). Breast and Colorectal Cancer Screening: US Primary Care Physicians' Reports of Barriers. *American journal of preventive medicine*, *43*(6), 584-589.

Mellström, C., & Johannesson, M. (2008). Crowding out in blood donation: was Titmuss right?. *Journal of the European Economic Association*, *6*(4), 845-863.

Meloy, M. G., Russo, J. E., & Miller, E. G. (2006). Monetary incentives and mood. *Journal of Marketing Research*, 267-275.

Meyer, P., Lovic, V., Saunders, B., Yager, L., Flagel, S., Morrow, J., & Robinson, T. (2012). Quantifying individual variation in the propensity to attribute incentive salience to reward cues. *PLOS*, 7(6), e38987.

Michalcuzk, R., & Mitchell, A. (2009). Monetary incentives for schizophrenia. *Cochrane Database of Systematic Reviews*, Issue 4, 20 pages.

Michie, S., & Abraham, C. (2004). Interventions to change health behaviours: evidence-based or evidence-inspired? *Psychology & Health*, 19(1), 29-49.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology: An International Review*, 57(4), 660-680.

Michie, S., Jochelson, K., Markham, W. A., & Bridle, C. (2009). Low-income groups and behaviour change interventions: a review of intervention content, effectiveness and theoretical frameworks. *Journal of epidemiology and community health*, *63*(8), 610-622.

Michie, S., & Prestwich, A. (2010). Are interventions theory-based? Development of a theory coding scheme. *Health Psychology*, 29(1), 1-8.

Michie, S., van Stralen Maartje, M., & Robert, W. (2011) The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*.

Michie, S., & Johnston, M. (2012). Theories and techniques of behaviour change: Developing a cumulative science of behaviour change. *Health Psychology Review*, 6(1), 1-6.

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, & Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of behavioral medicine*, *46*(1), 81-95.

Milkman, K. L., Beshears, J., Choi, J. J., Laibson, D., & Madrian, B. C. (2012). *Following through on good intentions: the power of planning prompts* (No. w17995). National Bureau of Economic Research.

Milkman, K. L., Mazza, M. C., Shu, L. L., Tsay, C. J., & Bazerman, M. H. (2012). Policy bundling to overcome loss aversion: A method for improving legislative outcomes. *Organizational Behavior and Human Decision Processes*, *117*(1), 158-167.

Mills, N., Daker-White, G., Graham, A., & Campbell, R. (2006). Population screening for Chlamydia Trachomatis infection in the UK: A qualitative study of the experiences of those screened. *Family Practice*, 23, 550-557.

Miltenberger, R. G. (2011). *Behavior Modification: Principles & Procedures*. CengageBrain. com.

Mojtabai, R., & Olfson, M. (2003). Medication costs, adherence, and health outcomes aong Medicare beneficiaries. *Health Affairs*, 22(4), 220-229.

Molinar D, Maurici C, Baraitser P, Macintosh M, & Nardone A (2009). *Financial Incentives for Chlamydia Testing: A Review of the Literature*. Warwick: Health Protection Conference.

Mongin, P. (1997). Expected Utility Theory. In J.Davis, W.Hands, & U.Maki (Eds.), *Handbook of Economic Methodology,* 342-350. London: Edward Elgar.

Monterosso, J. & Ainslie, G. (2007). The behavioural economics of will in recovery from addiction. *Drug and Alcohol Dependence*, 90(1), 100-111.

Montgomery, A., Peters, T., & Little, P. (2003). Design, analysis and presentation of factorial randomised controlled trials. *BMC Medical Research Methodology*, 3, 26-30.

Morewedge, C. K., Gilbert, D. T., Keysar, B., Berkovits, M. J., & Wilson, T. D. (2007). Mispredicting the hedonic benefits of segregated gains. *Journal of Experimental Psychology: General*, 136, 700-709.

Morewedge, C. K., Shu, L. L., Gilbert, D. T., & Wilson, T. D. (2009). Bad riddance or good rubbish? Ownership and not loss aversion causes the endowment effect. *Journal of Experimental Social Psychology*, *45*(4), 947-951.

Morisky, D., Malotte, C., Ebin, V., Davidson, P., Cabreara, D., Trout, P., & Coly, A. (2001). Behavioral interventions for the control of tuberculosis among adolescents. *Public Health Reports*, 116, 568-574.

Morris, S., Flores, R., Olinto, P., & Medina, J. (2004). Monetary incentives in primary health care and effects on use and coverage of preventive health care interventions in rural Honduras: Cluster randomised trial. *The Lancet*, 364, 2030-2037.

Mortensen, G. (2010). Drivers and barriers to acceptance of human-papillomavirus vaccination among young women: a qualitative and quantitative study. *BMC Public Health*, 10: 68 doi:10.1186/1471-2458-10-68.

Mortimer, D., Ghijben, P., Harris, A., & Hollingsworth, B. (2013). Incentive-based and non-incentive-based interventions for increasing blood donation. *The Cochrane Library* (protocol).

Moser K, Patnick J, Beral V. Inequalities in reported use of breast and cervical screening in Great Britain: analysis of cross sectional survey data. *BMJ* 2009;338:b2025.

Moss, S. M., Campbell, C., Melia, J., Coleman, D., Smith, S., Parker, R.,& Weller, D. P. (2012). Performance measures in three rounds of the English bowel cancer screening pilot. *Gut*, *61*(1), 101-107.

Munro, A. (2009). *Bounded Rationality and Public Policy: A perspective from Behavioural Economics*. London: Springer.

Munro, S., Lewin, S., Smith, H., Engel, M., Fretheim, A., & Volmink, J. (2007). Patient adherence to tuberculosis treatment: A systematic review of qualitative research. *PLoS Medicine*, 4(7), 1230-1244.

Murphy, J. J., Allen, P. G., Stevens, T. H., & Weatherhead, D. (2005). A meta-analysis of hypothetical bias in stated preference valuation. *Environmental and Resource Economics*, *30*(3), 313-325.

Murray, D., Varnell, S., & Blitstein, J. (2004). Design and analysis of group-randomized trials: A review of recent methodological developments. *Public Health Matters*, 94(3), 423-432.

Mytton, O., Gray, A., Rayner, M., & Rutter, H. (2007). Could targeted food taxes improve health? *Journal of epidemiology and community health*, *61*(8), 689-694.

Mytton, O. T., Clarke, D., & Rayner, M. (2012). Taxing unhealthy food and drinks to improve health. *BMJ: British Medical Journal*, *344*.

NCPIE – National Council for Patient Information and Education (2007). *Enhancing prescription medicine adherence: A national action plan*. Bethesda, MD: NCPIE.

Neumann, P. J. (2012). What we talk about when we talk about health care costs. *New England Journal of Medicine*, *366*(7), 585-586.

Nevin, J. A., & Grace, R. C. (2000). Behavioral momentum and the law of effect. *Behavioral and Brain Sciences*, *23*(1), 73-90.Roncaglia, A. (2005). *The Wealth of Ideas: A history of economic thought*. NY: Cambridge University Press.

Newman, G. E., & Jeremy Shen, Y. (2012). The counterintuitive effects of thank-you gifts on charitable giving. *Journal of Economic Psychology*, *33*(5), 973-983.

NHS (2003). *Evaluation of the UK Colorectal Cancer Screening Pilot*. Final Report UK http://www.cancerscreening.nhs.uk/bowel/finalreport.pdf

NHS (2006). *English Pilot of Bowel Cancer Screening: an evaluation of the 2nd round.* http://www.cancerscreening.nhs.uk/bowel/pilot-2nd-round-evaluation.pdf

NHS (2008). *Breast Cancer Screening Results from the NHSBSP 2006/ 07* http://www.cancerscreening.nhs.uk/breastscreen/uk-statistics-0607.pdf

NHS (2009). *NHS Cervical Screening Programme: Annual Review 2009*. http://www.cancerscreening.nhs.uk/cervical/publications/cervical-annual-review-2009.pdf

NICE (2009). *Medicines adherence: Involving patients in decisions about prescribed medicines and supporting adherence*. London, UK: NICE.

Nordström, J. & Thunström, L. (2011). The impact of tax reforms designed to encourage healthier grain consumption. *Journal of Health Economics*, 28(3), pp. 622-634.

O'Brien, L., Albert, D., Chein, J., and Steinberg, L. (2011). Adolescents prefer more immediate rewards when in the presence of their peers. Journal of Research on Adolescence, 21(4), 747-753.

O'Keefe, D. J., & Jensen, J. D. (2008). Do loss-framed persuasive messages engender greater message processing than do gain-framed messages? A meta-analytic review. *Communication Studies*, *59*(1), 51-67.

O'Keefe DJ & Jensen JD. (2009). The Relative Persuasiveness of Gain-Framed and Loss-Framed Messages for Encouraging Disease Detection Behaviors: A Meta-Analytic Review. Journal of Communication, 59(2):296-316

Oliver S, Bagnall AM, Thomas J, Shepherd J, Sowden A, White I, Dinnes J, Rees R, Colquitt J, Oliver K, Garrett Z (2008) *RCTs for policy interventions? A review of reviews and meta-regression*. Birmingham: University of Birmingham.

Oliver, A. (2009). Can financial incentives promote health equity? *BMJ*, 339, 705-706.

Oliver, A., & Brown, L. (2012). A consideration of user financial incentives to address health inequalities. *Journal of Health Politics, Policy and Law*, 37(2), 201-226.

Oliver, A. (2013). From Nudging to Budging: Using Behavioural Economics to Inform Public Sector Policy. *Journal of social policy*, *42*, 685-700.

Olmstead, T. A., Sindelar, J. L., & Petry, N. M. (2007). Cost-effectiveness of prize-based incentives for stimulant abusers in outpatient psychosocial treatment programs. *Drug and alcohol dependence*, *87*(2), 175-182.

Osterberg, L. & Blaschke, T. (2005). Adherence to medication. *New England Journal of Medicine*, 353(5), 487-497.

Paes, A., Bakker, A., Soe-Agnie, C. (1997). Impact of dosage frequency on patient compliance. *Diabetes Care*, 20(10), 1512-1517.

Paige, L., & Mansell, W. (2013). To attend or not attend? A critical review of the factors impacting on initial appointment attendance from an approach–avoidance perspective. *Journal of Mental Health*, 22(1), 72-82.

Parikh, A., Gupta, K., Wilson, A., Fields, K., Cosgrove, N. (2010). The Effectiveness of Outpatient Appointment Reminder Systems in Reducing No-Show Rates. *The American Journal of Medicine*, 123(6), 542-548.

Park, J. D., Mitra, N., & Asch, D. A. (2012). Public opinion about financial incentives for smoking cessation. *Preventive medicine*, 55(1), S41-S45.

Parke, H., Ashcroft, R., Brown, R., Marteau, T. M., & Seale, C. (2011). Financial incentives to encourage healthy behaviour: an analysis of UK media coverage. *Health Expectations*, 16(3), 292-304.

Parkin, D. M., Tappenden, P., Olsen, A. H., Patnick, J., & Sasieni, P. (2008). Predicting the impact of the screening programme for colorectal cancer in the UK. *Journal of medical screening*, *15*(4), 163-174.

Patel, M. & David, A. (2004). Medication adherence: predictive factors and enhancement strategies. *Psychiatry*, 6(9), 357-361.

Peck, J., & Shu, S. B. (2009). The effect of mere touch on perceived ownership. *Journal of Consumer Research*, *36*(3), 434-447.

Pessiglione, M., Schmidt,L., Draganski, B., Kalisch, R., Lau, H., Dolan, R., & Frith, C. (2007). How the Brain Translates Money into Force: A Neuroimaging Study of Subliminal Motivation. *Science*, 316(5826), 904–906.

Peterson AM, Takiya L, & Finley R. (2003). Meta-analysis of trials of interventions to improve medication adherence. *American Journal of Health-System Pharmacy,* 60(7), 657-65.

Petry, N. (2000). A comprehensive guide to the application of contingency management procedures in clinical settings. *Drug and Alcohol Dependence*, 58(1-2), 9-25.

Pettifor, A., Macphail, C., Nguyen, N., & Rosenberg, M. (2012). Can money prevent the spread of HIV? A review of cash payments for HIV prevention. *AIDS Behavior*, 16(7), 1729-1738.

Phillips, L., Branch, W., Cook, C., Doyle, J., El-Kebbi, I., Gallina, D., Miller, C., Ziemer, D., & Barnes, C. (2001). Clinical Inertia. *Annals of Internal Medicine*, 135(9), 825-834.

Philips, Z., Johnson, S., Avis, M., & Whynes, D. (2003). Human papillomavirus and the value of screening: Young women's knowledge of cervical cancer. *Health Education Research*, 18(3), 318-328.

Pokorny, K. (2008). Pay—but do not pay too much: An experimental study on the impact of incentives. *Journal of Economic Behavior & Organization*, *66*(2), 251-264.

Popay, J. (2008). Should disadvantaged people be paid to take care of their health? No. *BMJ: British Medical Journal*, *337*(7662), 141.

Powell, L.M. And Chaloupka, F.J. (2009). Food prices and obesity: evidence and policy implications for taxes and subsidies. *The Milbank Quarterly*, 87(1), pp. 229–257.

Prendergrast, J., Foley, B., Menne, V., & Isaac, A. (2008). *Creatures of Habit? The art of behavioural change*. London, UK: The Social Market Foundation.

Promberger, M., Brown, R. C., Ashcroft, R. E., & Marteau, T. M. (2011). Acceptability of financial incentives to improve health outcomes in UK and US samples. *Journal of medical ethics*, *37*(11), 682-687.

Promberger, M., Dolan, P., & Marteau, T. M. (2012). "Pay them if it works": Discrete choice experiments on the acceptability of financial incentives to change health related behaviour. *Social Science & Medicine*, 75(12), 2509–2514.

Promberger, M., & Marteau, T. M. (2013). Why and when might financial incentives crowd out intrinsic motivation for healthy behaviours? A comparison with behaviours used in the psychological and economic crowding-out literatures. *Health Psychology*, *32*(9), 950-957.

Propper, C., Burgess, S. & Green, K. (2004). Does competition between hospitals improve the quality of care? Hospital death rates and the NHS internal market. *Journal of Public Economics*, 88(7-8), 1247-1272

Rabin, M. (2013a). Incorporating limited rationality into economics. *Journal of Economic Literature*, *51*(2), 528-543.

Rabin, M. (2013b). An approach to incorporating psychology into economics. *The American Economic Review*, *103*(3), 617-622.

Ranganathan, M., & Lagarde, M. (2012). Promoting healthy behaviours and improving health outcomes in low and middle income countries: A review of the impact of conditional cash transfer programmes. *Preventive Medicine*, *55*, S95-S105.

Rasmussen JN, Chong A, Alter DA. Relationship between adherence to evidence-based pharmacotherapy and long-term mortality after acute myocardial infarction. *JAMA,* 297, 177-86.

Rawlings, L. B., & Rubio, G. M. (2005). Evaluating the impact of conditional cash transfer programs. *The World Bank Research Observer*, *20*(1), 29-55.

Reach, G. (2008). A novel conceptual framework for understanding the mechanism of adherence to long-term therapies. *Patient Preference and Adherence*, 2, 7-19.

Read, D., Loewenstein, G., & Rabin, M. (1999). Choice Bracketing. *Journal of Risk and Uncertainty*, *19*(1-3), 1-3.

Reb, J., & Connolly, T. (2010). Possession, Feelings of Ownership, and the Endowment Effect. *Judgment and Decision Making*, *2*(2), 107-114.

Redelmeier, D. & Kahneman, D. (1996). Patients' memories of painful medical treatments: real-time and retrospective evaluations of two minimally invasive procedures. *Pain*, 66(1), 3-8.

Redelmeier, D. A., Katz, J., & Kahneman, D. (2003). Memories of colonoscopy: a randomized trial. *Pain*, *104*(1), 187-194.

Reich, P., Roberts, P., Laabs, N., Chinn, A., McEvoy, P., Hirschler, N., et al. (2006). A randomized trial of blood donor recruitment strategies. *Transfusion, 46*(7), 1090-1096.

Rezayatmand, R., Pavlova, M., & Groot, W. (2013). The impact of out-of-pocket payments on prevention and health-related lifestyle: a systematic literature review. *The European Journal of Public Health*, *23*(1), 74-79.

Rice, T. (2013). The Behavioral Economics of Health and Health Care. *Annual review of public health*, *34*, 431-447.

Richardson, D., maple, K., Perry, N., ambler, E., Jurd, C., & Fisher, M. (2010). A pilot qualitative analysis of the psychosocial factors which drive young people to decline Chlamydia testing in the UK: Implications for health promotion and screening. *International Journal of STD & AIDS*, 21, 187-190.

Rietveld, S. & Koomen, J. (2002). A complex system perspective on medication compliance. *Disease Management Health Outcomes*, 10(10), 621-630.

Rigsby, M., Rosen, M., Beauvois, J., Cramer, J., Rainey, P., O'Malley, S., Dieckhaus, K., & Rounsaville, B. (2000). Cue-dose training with monetary reinforcement: Pilot study of an antiretroviral adherence intervention. *Journal of General Internal Medicine*, 15, 841-847.

Rizzo, J., Abbott, T., & Paschko, S. (1996). Labour productivity effects of prescribed medicines for chronically ill patients. *Health Economics*, 5, 249-265.

Roach, J. (2013). Grateful Patient Philanthropy: Is What's Good for the Goose Good for the Gander? *Journal of general internal medicine*, 1-2.

Rode, C., Cosmides, L., Hell, W., and Tooby, J. (1999). When and why do people avoid unknown probabilities in decision under uncertainty? Testing some predictions from optimal foraging theory. Cognition, 72, 269-304

Rodwin, M. A. (2004). Financial incentives for doctors: Have their place but need to be evaluated and used to promote appropriate goals. *BMJ: British Medical Journal*, *328*(7452), 1328.

Rosenbaum, P. R. (2005). Heterogeneity and causality. *The American Statistician*, *59*(2), 147-152.

Rosenberg, M. S. (1986). Maximizing the Effectiveness of Structured Classroom Management Programs: Implementing Rule-Review Procedures with Disruptive and Distractible Students. *Behavioral Disorders*, *11*(4), 239-48.

Rosenthal, R. & DiMatteo, R. (2001). Meta-analysis: Recent developments in quantitative methods for literature reviews. *Annual Review of Psychology*, 52, 59-82.

Ross, W. T., & Simonson, I. (1991). Evaluations of pairs of experiences: A preference for happy endings. *Journal of Behavioral Decision Making*, *4*(4), 273-282.

Roter, D. L., Hall, J. A., Merisca, R., Nordstrom, B., Cretin, D., & Svarstad, B. (1998). Effectiveness of interventions to improve patient compliance: a meta-analysis. *Medical care*, *36*(8), 1138-1161.

Rothman, A., Martino, S., Bedell, B., Detweiler, J., & Salovey, P. (1999). The systematic influence of gain-and loss-framed messages on interest in and use of different types of health behavior. *Personality and Social Psychology Bulletin*, 25, 1355-1369.

Rothman, A. J., Bartels, R. D., Wlaschin, J., & Salovey, P. (2006). The Strategic Use of Gain-and Loss-Framed Messages to Promote Healthy Behavior: How Theory Can Inform Practice. *Journal of Communication*, *56*(s1), S202-S220.

Ryan, R., & Deci, E. (2000). Self-detremination theory and the facilitation of intrinsic motivation, social development and well-being. *American Psychologist*, 55(1), 68-78.

Sabini, J., Siepmann, M. & Stein, J. (2001). The really fundamental attribution error in social psychological research. *Psychological Inquiry*, 12(1), 1-15.

Sanchez, A. M., Ameti, D. I., Schreiber, G. B., Thomson, R. A., Lo, A., Bethel, J., & Williams, A. E. (2001). The potential impact of incentives on future blood donation behavior. *Transfusion*, *41*(2), 172-178.

Sandel, M. J. (2012). *What Money Can't Buy: The Moral Limits of Markets.* New York: Farrar, Straus and Giroux.

Sanderson, S., Tatt, I. D., & Higgins, J. P. (2007). Tools for assessing quality and susceptibility to bias in observational studies in epidemiology: a systematic review and annotated bibliography. *International Journal of Epidemiology*, *36*(3), 666-676.

Sass, R. G. (2013). Toward a more stable blood supply: Charitable incentives, donation rates, and the experience of September 11. *The American Journal of Bioethics*, *13*(6), 38-45.

Saunders, J., Jobber, D., & Mitchell, V. (2006). The optimum prepaid monetary incentives for mail surveys. *The Journal of Operational Research Society*, 57(10), 1224-1230.

Scharff, R. L., & Viscusi, W. (2011). Heterogeneous rates of time preference and the decision to smoke. *Economic Inquiry*, *49*(4), 959-972.

Schedlbauer, A., Davies, P., & Fahey, T. (2010). Interventions to improve adherence to lipid lowering medication. Cochrane Database of Systematic Reviews 2010, Issue 3. art. no.: cd004371. doi: 10.1002/14651858.cd004371.pub3.

Schmidt, H., Voigt, K., & Wikler, D. (2010). Carrots, sticks, and health care reform—problems with wellness incentives. *New England Journal of Medicine*, *362*(2).

Schneider J, Kaplan SH, Greenfield S, Li W, Wilson IB (2004). Better physician-patient relationships are associated with higher reported adherence to antiretroviral therapy in patients with HIV infection. *Journal of General Internal Medicine,* 19(11), 1096-103.

Schroeder, K., Fahey, T., & Ebrahim, S. (2004). Interventions for improving adherence to treatment in patients with high blood pressure in ambulatory settings. *Cochrane Database of Systematic Reviews*, Issue 3, 32 pages.

Schwartz, A., Goldberg, J., and Hazen, G. (2008). Prospect theory, reference points and health decisions. *Judgment and Decision Making*, 3(2), 174-180.

Sciacca, J., Phillips, B., Hipps, D., Dube, M. & Ratcliff, M. (1995). Influences on Breast-Feeding by Lower-Income Women: An Incentive-Based, Partner-Supported Educational Program. *Journal of the American Dietetic Association*, 95(3), 323-328.

Seal, K., Kral, A., Lorvick, J., McNees, A., Gee, L., & Edlin, B. (2003). A randomized controlled trial of monetary vs. outreach to enhance adherence to the hepatitis B vaccine series among injection drug users. *Drug and Alcohol Dependence*, 71, 127-131.

Segal, B., and Podoshen, J. (2012). An examination of materialism, conspicuous consumption and gender differences. *International Journal of Consumer Studies*.

Senik, C. (2008). Is man doomed to progress? *Journal of economic behavior & organization*, *68*(1), 140-152.

Sewitch MJ, Abrahamowicz M, Barkun A, *et al.* Patient nonadherence to medication in inflammatory bowel disease. *American Journal of Gastroenterology*, 98, 1535-44.

Shang, J., & Croson, R. (2009). A field experiment in charitable contribution: The impact of social information on the voluntary provision of public goods. *The Economic Journal*, *119*(540), 1422-1439.

Shaw, J. (2007). Is it acceptable for people to be paid to adhere to medication? No. *BMJ*, 335, 232-233.

Shrikrishna, D. (2009). Financial incentives for smoking cessation. *Thorax,* 64, 639.

Shumaker, S. A., Ockene, J. K., & Riekert, K. A. (Eds.). (2009). *The handbook of health behavior change*. Springer Publishing Company.

Silverman, I. (2003). Gender differences in delay of gratification: A meta-analysis. *Sex Roles*, 49(9-10), 451-463.

Simpson S., Eurich D., Majumdar S., Padwaal, R., Tsuyuki, R., Varney, R., & Johnson**,** J**.** (2006). A meta-analysis of the association between adherence to drug therapy and mortality. *BMJ,* 333(7557), 15.

Singer, E., van Hoewyk, J., & Maher. M. (2000). Experiments with incentives in telephone surveys. *Public Opinion Quarterly*, 64, 171-188.

Skinner, B. F. (1953). *Science and human behavior*. New York: Macmillan.

Skinner, B. F. (1971). *Beyond Freedom and Dignity*. NY: Alfred Knopf.

Skinner, B. F. (1976). *About Behaviorism*. NY: Vintage Books Edition.

Slater, J., Henly, G., Ha, C., Malone, M., Nyman, J., Diaz, S., & McGovern, P. (2005). Effect of direct mail as a population-based strategy to increase mammography use among low-income underinsured women ages 40 to 64 years. *Cancer Epidemiology Biomarkers Prevention*, 14(10), 2346-2352.

Smith, M. (2004). Incentives. In G. Burgess & H. Burgess (Eds.), *Beyond Intractability*. Colorado, USA: Conflict Research Consortium, University of Colorado, Boulder.

Smith, P., & York, N. (2004). Quality Incentives: The Case Of U.K. General Practitioners. *Health Affairs*, 23(3), 112-118.

Smith, R. A., Cokkinides, V., & Brawley, O. W. (2012). Cancer screening in the United States, 2012. *CA: A Cancer Journal for Clinicians*, *62*(2), 129-142.

Sokol, M., McGuigan K., Verbrugge R., & Epstein RS. (2005). Impact of medication adherence on hospitalization risk and health care cost. *Medical Care.*43, 521-30.

Solow, R. M. (1971). Blood and Thunder. *The Yale Law Journal, 80*(8), 1696-1711.

Spaulding, A., Fendrick, A., Herman, W., Stevenson, J., Smith, D., Chernew, M., Parsons, D., Bruhnsen, K., & Rosen, A. (2009). A controlled trial of value-based insurance design - The MHealthy Focus on Diabetes (FOD) trial. *Implementation Science*, 4, 19-29.

Stajkovic, A. D., and F. Luthans. (1997). A Meta-Analysis of the Effects of Organizational Behavior Modification on Task Performance, 1975-95. *The Academy of Management Journal* 40 (5): 1122-1149.

Stajkovic, A., F. Luthans. (2001). Differential effects of incentive motivators on work performance. *The Academy of Management Journal* 44(3): 580-590.

Starmer, C. (2000). Developments in non-expected utility theory: The hunt for a descriptive theory of choice under risk. *Journal of economic literature*, *38*(2), 332-382.

Stavropoulou, C. (2008). *The doctor-patient relationship and adherence to medication*. PhD Dissertation, Department of Social Policy London School of Economics.

Sterne, J. (2009). Meta-analysis in Stata: an updated collection from the Stata Journal. *Meta-Analysis In Stata: An Updated Collection From The Stata Journal-9781597180498-52, 88*.

Stevenson, M. (1993). Decision making with long-term consequences: temporal discounting for single and multiple outcomes in the future. *Journal of Experimental Psychology: General*, 122(1), 3-22.

Stone, E. G., Morton, S. C., Hulscher, M. E., Maglione, M. A., Roth, E. A., Grimshaw, J. M., & Shekelle, P. G. (2002). Interventions That Increase Use of Adult Immunization and Cancer Screening ServicesA Meta-Analysis. *Annals of Internal Medicine*, *136*(9), 641-651.

Strough, J., Karns, T. E., & Schlosnagle, L. (2011). Decision-making heuristics and biases across the life span. *Annals of the New York Academy of Sciences*, *1235*(1), 57-74.

Stutzer, A., Goette, L., & Zehnder, M. (2011). Active Decisions and Prosocial Behaviour: a Field Experiment on Blood Donation. *The Economic Journal*, *121*(556), F476-F493.

Stubbs, N., Graci, S., Stephenson, P., Jones, D., & Sanders, S. (2012). Methods to reduce outpatient non-attendance. *American Journal of Medical Science*, 344(3), 211-219.

Sutherland, K., Christianson, J. B., & Leatherman, S. (2008a). Impact of Targeted Financial Incentives on Personal Health Behavior A Review of the Literature. *Medical Care Research and Review*, *65*(6 suppl), 36S-78S.

Sutherland, K., Leatherman, S., & Christianson, J. (2008b). *Paying the patient: does it work? A review of patient-targeted incentives.* London, UK: The Health Foundation.

Szczepura, A., Price, C., & Gumber, A. (2008). Breast and bowel cancer screening uptake patterns over 15 years for UK south Asian ethnic minority populations, corrected for differences in socio-demographic characteristics. *BMC Public Health*, *8*(1), 346.

Tebb, K., Paukku, M., Pai-Dhungat, M., Gyamfi, A., & Shafer, M. (2004). Home STI testing: The adolescent female's opinion. *Journal of Adolescent Health*, 35, 462-467.

Tetlock, P. E., Kristel, O. V., Elson, S. B., Green, M. C., & Lerner, J. S. (2000). The psychology of the unthinkable: Taboo trade-offs, forbidden base rates, and heretical counterfactuals. *Journal of Personality and Social Psychology, 78*(5), 853-870.

Thaler, R. (1985). Mental accounting and consumer choice. *Marketing Science*, 4(3), 199-214.

Thaler, R. H. (1990). Anomalies: Saving, fungibility, and mental accounts. *The Journal of Economic Perspectives*, *4*(1), 193-205.

Thaler, R. (1999, 2004). Mental accounting matters. *Journal of Behavioral Decision Making*, 12(3), 183-206.

Thaler, R. (2008). Mental accounting and consumer choice. *Marketing Science*, *27(1)*, 15-25.

Thaler, R., & Johnson, E. (1990). Gambling with the House Money and Trying to Break Even: The Effects of Prior Outcomes in Risky Choice. *Management Science*, 36(6), 643-660.

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press.

Thompson, S. G., & Higgins, J. (2002). How should meta-regression analyses be undertaken and interpreted? *Statistics in medicine*, *21*(11), 1559-1573.

Thorndike, E. L. (1911). *Animal intelligence: Experimental studies*. New York : Macmillan.

Thornton, R. (2008). The demand for and impact of learning HIV status. *American Economic Review*, 98(5), 1829-1863.

Thow, A. M., Jan, S., Leeder, S., & Swinburn, B. (2010). The effect of fiscal policy on diet, obesity and chronic disease: a systematic review. *Bulletin of the World Health Organization*, *88*(8), 609-614.

Titmuss, R. (1970). *The Gift Relationship: from human blood to social policy*. London: George Allen and Unwin.

Thorgeirsson, T., & Kawachi, I. (2013). Behavioral Economics: Merging Psychology and Economics for Lifestyle Interventions. *American journal of preventive medicine*, *44*(2), 185-189.

Townsend J, Roderick P, Cooper J. Cigarette smoking by socio-economic group, sex, and age: effects of price income and publicity. *BMJ*, 309, 923–927.

Trivedi, A. N., Rakowski, W., & Ayanian, J. Z. (2008). Effect of cost sharing on screening mammography in Medicare health plans. *New England Journal of Medicine*, *358*(4), 375-383.

Tusky, J., Hahn, J., Long, H., Chambers, D., Robertson, M., Chesney, M., & Moss, A. (2004). Can the poor adhere? Incentives for adherence to TB prevention in homeless adults. *International Journal of Tuberculosis Lung Disease*, 8(1), 83-91.

Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *Journal of business*, S251-S278.

Tversky, A. & Kahneman, D. (1991). Loss Aversion in Riskless Choice: A Reference-Dependent Model. *The Quarterly Journal of Economics*, 106(4), 1039-61.

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty* 5(4), 297-323.

Ubel, P., Loewenstein, G., Hershey, J., Baron, J., Mohr, T., Asch, D., & Jepson, C. (2001). Do non-patients underestimate the quality of life associated with chronic health conditions because of a focusing illusion? *Medical Decision Making*, 21, 190-200.

Unti, L., Coyle, K., Woodruff, B., & Boyer-Chuanroong, L. (1997). Incentives and motivators in school-based hepatitis B vaccination programs. *Journal of School Health*, 67(7), 265-268.

Urban AB, Stout PA, Zimet GD,Blake DR.(2006). The influence of message framing on adolescent females' intention to obtain Chlamydia screening. Journal of Adolescent Health, 38: 126.

Van Der Poel, C. L., Seifried, E., & Schaasberg, W. P. (2002). Paying for blood donations: still a risk? *Vox Sanguinis, 83*(4), 285-293.

Van Dulmen, S., Sluijs, E., van Dijk, L., de Ridder, D., Heerdink, R., & Bensing, J. (2007). Patient adherence to medical treatment: A review of reviews. *BMC Health Services Research*, 7, 55-71.

Vandrey, R., Bigelow, G., & Stitzer, M. (2007). Contingency management in cocaine abusers: A dose-effect comparison of goods-based versus cash-based incentives. *Experimental Clinical Psychopharmacology*, 15(4), 338-343.

Varey, C., & Kahneman, D. (1992). Experiences extended across time: Evaluation of moments and episodes. *Journal of Behavioral Decision Making*, *5*(3), 169-185.

Vermeire, E., Hearnshaw, H., van Royen, P., & Denekens, J. (2001). Patient adherence to treatment: Three decades of research. *Journal of Clinical Pharmacy and Therapeutics*, 26, 331-342.

Vlaev, I., Chater, N., Stewart, N., & Brown, G. D. (2011). Does the brain calculate value?. *Trends in cognitive sciences*, *15*(11), 546-554.

Vohs, K. D., Mead, N. L., & Goode, M. R. (2008). Merely activating the concept of money changes personal and interpersonal behavior. *Current Directions in Psychological Science*, *17*(3), 208-212.

Volmink, J., & Garner, P. (1997). Systematic review of randomized controlled trials of strategies to promote adherence to tuberculosis treatment. *BMJ*, 315, 1403-1406.

Volpp, K., John, L., Troxel, A., Norton, L., Fassbender, J., & Loewenstein, G. (2008a). Financial incentive-based approaches to weight-loss: A randomized trial. *JAMA*, 300(22), 2631-2637.

Volpp, K. G., Troxel, A. B., Pauly, M. V., Glick, H. A., Puig, A., Asch, D. A. & Audrain-McGovern, J. (2009a). A randomized, controlled trial of financial incentives for smoking cessation. *New England Journal of Medicine*, *360*(7), 699-709.

Volpp. K., Pauly, M., Loewenstein, G., & Bangsberg, D. (2009b). P4P4P: An Agenda for research on pay-for-performance for patients. *Market Watch*, January/ February, 206-215.

Von Neumann, J. & Morgensten, O. (1944). *Theory of Games and Economic Behavior*. NJ: Princeton University Press.

Von Thadden, E. L., & Zhao, X. (2012). Incentives for unaware agents. *The Review of Economic Studies*, *79*(3), 1151-1174.

von Wagner, C., Good, A., Smith, S. G., & Wardle, J. (2012). Responses to procedural information about colorectal cancer screening using faecal occult blood testing: the role of consideration of future consequences. *Health Expectations*, *15*(2), 176-186.

Vrijens, B., de Geest, S., Hughes, D., Przemyslaw, K., Demonceau, J., Ruppar, T., Dobbels, F., Fargher, E., Morrison, V., Lewek, P., Matyjjaszczyk, M., Mshelia, C.,, Clyne, W., Aronson, J., & Urquhart, J. (2012). A new taxonomy for describing and defining adherence to medications. *British Journal of Clinical Pharmacology*, 73(5), 691-705.

Waller, J., Bartoszek, M., Marlow, L., & Wardle, J., (2009). Barriers to cervical cancer screening attendance in England: A population-based survey. *Journal of Medical Screening*, 16(4), 199-204.

Warner, K. E., & Murt, H. A. (1984). Economic incentives for health. *Annual review of public health*, *5*(1), 107-133.

Warriner, K., Goyder, J., Gjertsen, H., Hohner, P., & McSpurren, K. (1996). Charities, no; lotteries, no; cash, yes: Main effects and interactions in a Canadian incentives experiment. *Public Opinion Quarterly*, 60, 542-562.

Weaver, J., Vandello, J., Bosson, J. (2012). Intrepid, imprudent, or impetuous?: The effects of gender threats on men's financial decisions. *Psychology of Men and Masculinity.*

Webb R, Richardson J, Esmail A, Pickles A. Uptake for cervical screening by ethnicity and place-of-birth: a population-based cross-sectional study. *J Public Health* 2004, 26: 293–29.

Weber, B. J., & Chapman, G. B. (2005). The combined effects of risk and time on choice: Does uncertainty eliminate the immediacy effect? Does delay eliminate the certainty effect? *Organizational Behavior and Human Decision Processes*, *96*(2), 104-118.

Weinstein, N., & Klein, W., (1996). Unrealistic optimism: present and future. *Journal of Social and Clinical Psychology*, 15, 1-8.

Welch J L, & Thomas-Hawkins C. Psycho-educational strategies to promote fluid adherence in adult hemodialysis patients: a review of intervention studies. International Journal of Nursing Studies 2005; 42(5), 597-608.

Weller, D. & Campbell, C. (2009). Uptake in cancer screening programmes: A priority in cancer control. *British Journal of Cancer*, 101, 55-59.

Weller, D., Patnick, J., McIntosh, H., & Dietrich, A. (2009). Uptake in cancer screening programmes. *The Lancet Oncology*, 10, 693-698.

White, R. W. (1959). Motivation reconsidered: the concept of competence. *Psychological review*, *66*(5), 297.

WHO (2003). *Adherence to long-term therapies: Evidence for action*. http://www.who.int/chronic_conditions/adherence-port/eng/2003

WHO (2003). *Compliance to long-term therapies: Evidence for action*. http://www.who.int/chronic_conditions/compliance-port/eng/2003

WHO (2009). *The Melbourne Declaration on 100% Voluntary Non-remunerated Donation of Blood and Blood Components* 2012, from http://www.who.int/worldblooddonorday/MelbourneDeclarationWBDD09.pdf

Whynes, D., Philips, Z., & Avis, M. (2007). Why do women participate in the English cervical cancer screening programme? *Journal of Health Economics*, 26, 306-352.

Wiedemann, A. U., Schüz, B., Sniehotta, F., Scholz, U., & Schwarzer, R. (2009). Disentangling the relation between intentions, planning, and behaviour: A moderated mediation analysis. *Psychology and Health*, *24*(1), 67-79.

Williams, G. C., Rodin, G. C., Ryan, R. M., Grolnick, W. S., & Deci, E. L. (1998). Autonomous regulation and adherence to long-term medical regimens in adult outpatients. *Health Psychology*, *17*, 269-276.

Williams, S., DiMatteo, R., & Haskard, K. (2009). Psychosocial barriers to adherence and lifestyle change. In S. Shumaker, J., Ockene, & K. Riekert (Eds.), *The Handbook of Health Behavior Change*, 445-462. NY: Springer Publishing.

Wilson, T. D., & Gilbert, D. T. (2005). Affective forecasting knowing what to want. *Current Directions in Psychological Science*, *14*(3), 131-134

Winter, L. & Parker, B. (2007). Current health and preferences for life-prolonging treatments: an application of Prospect theory to the end-of-life decision making. *Social Science & Medicine*, 65, 1695-1707.

Wise, J. (2010). NICE Citizens Council debates incentives for healthy behaviour. *BMJ*, 340, c2747

Worthy, D., Gorlick, M., Pacheco, J., Schyer, D., and Maddox, W. (2011). With age comes wisdom: Decision making in younger adults and older adults. *Psychological Science*, 22(11), 1375-1380.

Wrede-Sach, J., Voigt, I., Diederichs-Egidi, H., Hummers-Pradier, E., Dierks, M. L., & Junius-Walker, U. (2013). Decision-Making of Older Patients in Context of the Doctor-Patient Relationship: A Typology Ranging from "Self-Determined" to "Doctor-Trusting" Patients. *International journal of family medicine*, *10 pages.*

Wyer, R. S., Xu, A. J., & Shen, H. (2012). 5 The Effects of Past Behavior on Future Goal-Directed Activity. *Advances in Experimental Social Psychology*, *46*, 237.

Wysocki, T., Greco, P., Harris, M., Bubb, J., & White, N. (2001). Behavior theraphy for families of adolescents with diabetes: Maintenance of treatment effects. *Diabetes Care*, 24(3), 441-446.

Yabroff, K. & Mandelblatt, J. (1999). Interventions targeted toward patients to increase mamography use. *Cancer Epidemiology, Biomarkers & Prevention*, 8, 749-757.

Yao, H., wei, X., Liu, J., Zhao, J., Hu, D., & Walley, D. (2008). Evaluating the effects of providing financial incentives to tuberculosis patients and health providers in China. *International Journal of Tuberculosis Lung Disease*, 12(10), 1166-1172.

Yaqub, M., Saz, G., & Hussain, D. (2009). A meta-analysis of the empirical evidence on expected utility theory. *European Journal of Economics, Finance and Administrative Sciences*, 15, 117-134.

Ye, X., Gross, C., Schommer, J., Cline, R., & Peter, W. (2007). Association between copayment and adherence to statin treatment initiated after coronary heart

disease hospitalization: a longitudinal, retrospective, cohort study. *Clinical Therapeutics*. 29(12), 2748-2757.

Yechiam, E., & Hochman, G. (2013). Losses as modulators of attention: Review and analysis of the unique effects of losses over gains. Psychological Bulletin, 139(2), 497-518.

Zauberman, G., Kim, B. K., Malkoc, S. A., & Bettman, J. R. (2009). Discounting time and time discounting: Subjective time perception and intertemporal preferences. *Journal of Marketing Research*, *46*(4), 543-556.

Zenner D, Molinar D, Nichols T, Riha J, Macintosh M, Nardone A. Should young people be paid for getting tested? A national comparative study to evaluate patient financial incentives for chlamydia screening. BMC Public Health 2012;12(1):261.

Zygmunt, A., Olfson, M., Boyer, C., & Mechanic, D**.** (2002). Interventions to Improve Medication Adherence in Schizophrenia. *American Journal of Psychiatry*, 159, 1653-1664.

Papers included in the qualitative review about compliance

Atella, V., Peracchi, F., Depalo, D., & Rossetti, C. (2006). Drug compliance, co-payment and health outcomes: Evidence from a panel of Italian patients. *Health Economics*, 15, 875-892.

Birkhead, G., LeBaron, C., Parsons, P., Grabau, J., Barr-Gale, L., Fuhrman, J., Brooks, S., Rosenthal, J., Hadler, S., & Morse, D. (1995). The immunization of children enrolled in the special supplemental food program for women, infants and children (WIC). *JAMA*, 274(4), 312-316.

Bock, N., Sales, R., Rogers, T., & DeVoe, B. (2001). A spoonful of sugar...improving adherence to tuberculosis treatment using financial incentives. *International Journal of Tuberculosis Lung Disease*, 5(1), 96-98.

Breen, N., Feuer, E. J., Depuy, S., & Zapka, J. (1997). The effect of Medicare reimbursement for screening mammography on utilization and payment. National Cancer Institute Breast Cancer Screening Consortium. *Public Health Reports*, *112*(5), 423.

Capelli, C. A. (1990). Behavioral contracting with a monetary incentive program to improve fluid compliance of hemodialysis patients. Doctoral Dissertation.

Carey, K. B., & Carey, M. P. (1990). Enhancing the treatment attendance of mentally ill chemical abusers. *Journal of Behavior Therapy and Experimental Psychiatry*, *21*(3), 205-209.

Carey, M., Senn, T., Coury-Doniger, P., & Urban, M. (2005). Recruiting patients from a sexually transmitted disease clinic to sexual risk reduction workshops: Are monetary incentives necessary? *Journal of Public Health Management Practice*, 11(6), 516-521.

Chacko, M., Cromer, B., Phillips, S., & Glasser, D. (1987). Failure of a lottery incentive to increase compliance with return visit for test-of-cure culture for Neisseria Gonorrhoeae. *Sexually Transmitted Diseases*, 14(2), 75-78.

Chaisson, R., Keruly, J., McAvinue, S., Gallant, J., & Moore, R. (1996). Effects of an incentive and education program on returns rates for PPD test reading in patients with HIV infection. *Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology*, 11(5), 455-459.

Chernew, M., Shah, M. ,Wegh, A., Rosenberg, S., Juster, I., Rosen, A., Sokol, M., Yu-Isenberg, K. & Fendrick, M. (2008). Impact of decreasing copyaments on medication adherence within a disease management environment. *Health Affairs*, 27(1), 103-112.

Currie, M. J., Schmidt, M., Davis, B. K., Baynes, A. M., O'Keefe, E. J., Bavinton, T. P., & Bowden, F. J. (2010). 'Show me the money': financial incentives increase chlamydia screening rates among tertiary students: a pilot study. *Sexual health*, *7*(1), 60-65.

Davidson, H., Schluger, N., Feldman, P., Valentine, D., Telzak, E. & Laufer, F. (2000). The effects of increasing incentives on adherence to tuberculosis directly observed therapy. *International Journal of Tuberculosis Lung Disease*, 4(9), 860-865.

Doshi, J. A., Zhu, J., Lee, B. Y., Kimmel, S. E., & Volpp, K. G. (2009). Impact of a prescription copayment increase on lipid-lowering medication adherence in veterans. *Circulation*, *119*(3), 390-397.

Foxman, B., Valdez, R. B., Lohr, K. N., Goldberg, G. A., Newhouse, J. P., & Brook, R. H. (1987). The effect of cost sharing on the use of antibiotics in ambulatory care: results from a population-based randomized controlled trial. *Journal of Chronic Diseases*, *40*(5), 429-437.

Freedman, J. D., & Mitchell, C. K. (1994). A simple strategy to improve patient adherence to outpatient fecal occult blood testing. *Journal of general internal medicine*, *9*(8), 462-464.

Hagihara, A., Murakami, M., Chishaki, A., Nabeshima, F., & Nobutomo, K. (2001). Rate of health insurance reimbursement and adherence to anti-hypertensive treatment among Japanese patients. *Health Policy*, 58, 231-242.

Hankin, J. R., Steinwachs, D. M., & Elkes, C. (1980). The impact on utilization of a copayment increase for ambulatory psychiatric care. *Medical Care*, 807-815.

Hart, R. R. (1979). Utilization of token economy within a chronic dialysis unit. *Journal of consulting and clinical psychology*, *47*(3), 646.

Haukoos, J. S., Witt, M. D., Coil, C. J., & Lewis, R. J. (2005). The effect of financial incentives on adherence with outpatient human immunodeficiency virus testing referrals from the emergency department. *Academic emergency medicine*, *12*(7), 617-621.

Helmus, T. C., Saules, K. K., Schoener, E. P., & Roll, J. M. (2003). Reinforcement of counseling attendance and alcohol abstinence in a community-based dual-diagnosis treatment program: A feasibility study. *Psychology of Addictive Behaviors*, *17*(3), 249.

Hynd, A., Roughead, E. E., Preen, D. B., Glover, J., Bulsara, M., & Semmens, J. (2008). The impact of co-payment increases on dispensings of government-subsidised medicines in Australia. *Pharmacoepidemiology and drug safety*, *17*(11), 1091-1099.

Ives, D., Lave, J., Traven, N., & Kuller, L. (1994). Impact of Medicare reimbursement on influenza vaccination rates in the elderly. *Preventive Medicine*, 23, 134-141.

Iwata, B., & Becksfort, C. (1981). Behavioral research in preventive dentistry: Educational and contingency management approaches to the problem of patient compliance. *Journal of Applied Behavior Analysis*, 14, 111-120.

Kelaher, M., & Stellman, J. M. (2000). The impact of Medicare funding on the use of mammography among older women: implications for improving access to screening. *Preventive Medicine*, *31*(6), 658-664.

Keperlman, L., Connell, D., & Gunn, W. (2000). Effect of a monetary sanction on immunization rates of recipients of aid to families with dependent children.

JAMA, 284(1), 53-59.

Kiefe, C. McKay, S., Halevy, A., & Brody, B. (1994). Is cost a barrier to screening mammography for low-income women receiving Medicare benefits? *Archives of Internal Medicine*, 154, 1217-1224.

Kissinger, P., Kopicko, J. J., Myers, L., Wustrack, S., Elkins, W., Farley, T. A., & Martin, D. (2000). The effect of modest monetary incentives on follow-up rates in sexually transmitted disease studies. *International journal of STD & AIDS*, *11*(1), 27-30.

Klassen, A. C., Smith, A. L., Meissner, H. I., Zabora, J., Curbow, B., & Mandelblatt, J. (2002). If we gave away mammograms, who would get them? A neighborhood evaluation of a no-cost breast cancer screening program. *Preventive medicine*, *34*(1), 13-21.

Kominski, G. F., Varon, S. F., Morisky, D. E., Malotte, C. K., Ebin, V. J., Coly, A., & Chiao, C. (2007). Costs and cost-effectiveness of adolescent compliance with treatment for latent tuberculosis infection: results from a randomized trial. *Journal of adolescent health*, *40*(1), 61-68.

Laken, M., & Ager, J. (1995). Using incentives to increase participation in prenatal care. *Obstetrics & Gynecology*, 85(3), 326-329.

Leibowitz, A., Manning, W. G., & Newhouse, J. P. (1985). The demand for prescription drugs as a function of cost-sharing. *Social science & medicine*, *21*(10), 1063-1069.

Lurie, N., Kamberg, C. J., Brook, R. H., Keeler, E. B., & Newhouse, J. P. (1989). How free care improved vision in the health insurance experiment. *American journal of public health*, *79*(5), 640-642.

Maciejewski, M. L., Farley, J. F., Parker, J., & Wansink, D. (2010). Copayment reductions generate greater medication adherence in targeted patients. *Health Affairs*, *29*(11), 2002-2008.

Manning, W., Newhouse, J., Duan, N., Keeler, E., & Leibowitz, A. (1987). Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment. *The American Economic Review*, 77(3), 251-277.

Marcus, A., Crance, L., Kaplan, C., Reading, A., Savage, E., Gunning, J., Bernstein, G., & Berek, J. (1992). Improving adherence to screening follow-up among women with abnormal pap smears: Results from a large clinic-based trial of

three intervention strategies. *Medical Care*, 30(3), 216-230.

Marcus, A., Kaplan, C., Crane, L., Berek, J., Bernstein, G., Gunning, J., & McClatchey, M. (1998). Reducing loss-to-follow-up among women with abnormal pap smears: Results from a randomized trial testing an intensive follow-up protocol and economic incentives. *Medical Care*, 36(3), 397-410

Mayer, J., & Kellogg, M. (1989). Promoting mammography appointment making. *Journal of Behavioral Medicine*, 12(6), 605-611.

Mayoryk, S., & Levy, S. (2006). Incentive program increases employee influenza vaccine compliance at a chronic hospital/ long-term care facility. *American Journal of Infection Control*, publication 7-50.

Meeker, D., Joyce, G. F., Malkin, J., Teutsch, S. M., Haddix, A. C., & Goldman, D. P. (2011). Coverage and preventive screening. *Health services research*, *46*(1p1), 173-184.

Melnikow, J., Paliescheskey, M., & Stewart, G. (1997). Effect of a transportation incentive on compliance with the first prenatal appointment: A randomized trial. *Obstetrics & Gynecology*, 89(6), 1023-1027.

Miller, M. F., & Wong, J. G. (1993). Reducing financial barriers enhances the return rate of stool Hemoccult packets. *The American journal of the medical sciences*, *306*(2), 98-100.

Minkovitz, C., Holt, E., Hughart, N., Hou, W., Thomas, L., Dini, E., & Guyer, B. (1999). The effect of parental monetary sanctions on the vaccination status of young children: an evaluation of welfare reform in Maryland. *Archives of pediatrics & adolescent medicine*, *153*(12), 1242.

Morisky, D., Malotte, C., Ebin, V., Davidson, P., Cabreara, D., Trout, P., & Coly, A. (2001). Behavioral interventions for the control of tuberculosis among adolescents. *Public Health Reports*, 116, 568-574.

Motheral, B. R., & Henderson, R. (1999). The effect of a copay increase on pharmaceutical utilization, expenditures, and treatment continuation. *The American journal of managed care*, *5*(11), 1383.

Nair, K., Miller, K., Saseen, J., Wolfe, P., Allen, R., & Park, J. (2009). Prescription copay reduction program for diabetic employees: Impact on medication compliance and healthcare costs and utilization. *American Health and Drug Benefits*, 2(1), 14-24.

Nexoe, J., Kragstrup, J., & Ronne, T. (1997). Impact of postal invitations and user fee on influenza vaccination rates among the elderly. *Scandinavian Journal of Primary Health Care*, 15, 109-112.

Perlman, D., Friedmann, P., Horn, L., Nugent, A., Schoeb, V., Carey, J., Salomon, N., & Jarlais, D. (2003). Impact of monetary incentives on adherence to referral for screening chest X-rays after syringe exchange-based tuberculin skin testing. *Journal of Urban Health*, 80(3), 428-437.

Post, E., Cruz, M. & Harman, J. (2006). Incentive payment for attendance at appointments for depression among low-income African Americans. *Psychiatric Services*, 57(3), 414-416.

Powers, C., Mathu-Muju, K., & Bush, H. (2009). Effect of a financial incentive on returning for post-operative care following general anaesthesia. *The Journal of Clinical Pediatric Dentistry*, 33(4), 347-350.

Rhodes, G. L., Saules, K. K., Helmus, T. C., Roll, J., BeShears, R. S., Ledgerwood, D. M., & Schuster, C. R. (2003). Improving on

Rice, J. M., & Lutzker, J. R. (1984). Reducing noncompliance to follow-up appointment keeping at a family practice center. *Journal of applied behavior analysis*, *17*(3), 303-311.

Satterthwaite, P. (1997). Randomized intervention study to examine the effect on immunization coverage of making influenza vaccine available at no cost. *New Zealand Medical Journal*, 110, 58–60.

Schillinger, J. A., Mosbaek, C., Austin, D., Jack Jr, L., Heumann, M., Moore, J., ... & Fleming, D. W. (2000). Health care reform in Oregon: The impact of the Oregon Health Plan on utilization of mammography. *American journal of preventive medicine*, *18*(1), 11-17.

Sedjo, R. L., & Cox, E. R. (2008). Lowering copayments: impact of simvastatin patent expiration on patient adherence. *Am J Manag Care*, *14*(12), 813-8.

Sigmon, S. C., & Stitzer, M. L. (2005). Use of a low-cost incentive intervention to improve counseling attendance among methadone-maintained patients. *Journal of substance abuse treatment*, *29*(4), 253-258.

Skaer, T. L., Robison, L. M., Sclar, D. A., & Harding, G. H. (1996). Financial incentive and the use of mammography among Hispanic migrants to the United States. *Health care for women international*, *17*(4), 281-291.

Simon, G. E., Grothaus, L., Durham, M. L., & VonKorff, M. (1996). Impact of visit copayments on outpatient mental health utilization by members of a health maintenance organization. *The American journal of psychiatry, 153(3), 331-338*.

Smith, P., Weinman, M., Johnson, T., & Wait,R. (1990). Incentives and their influence on appointment compliance in a teenage family-planning clinic. *Journal of Adolescent Health Care*, 11(5), 445-448.

Sonnier, B. L. (2000). *Effects of Self-monitoring and Monetary Reward on Fluid Adherence Among Adult Hemodialysis Patients* (Doctoral dissertation, University of North Texas).

Sorensen, J., Haug, N., Delucchi, K., Gruber, V., Kletter, E., Batki, S., Tulsky, J., Barnett, P., & Hall, S. (2007). Voucher reinforcement improves medication adherence in HIV-positive methadone patients: A randomized trial. *Drug and Alcohol Dependence*, 88(1), 54-63.

Stevens-Simon, C., O'Connor, P. & Bassford, K. (1994). Incentives enhance postpartum compliance among adolescent prenatal patients. *Journal of Adolescent Health*, 15, 396-399.

Stoner, T., Dowd, B., Carr, P., Maldonado, G., Church, T., & Mandel, J. (1998). Do vouchers improve breast cancer screening? Results from a randomized trial. *Health Research Services*, 33(1), 11-28.

Volpp, K., Loewenstein, G., Troxel, A., Doshi, J., Price, M., Laskin, M. & Kimmel, S. (2008). A test of financial incentives to improve warfarin adherence. *BMC Health Services Research*, 8, 272-278.

Zeng, F., An, J. J., Scully, R., Barrington, C., Patel, B. V., & Nichol, M. B. (2010). The impact of value-based benefit design on adherence to diabetes medications: a propensity score-weighted difference in difference evaluation. *Value in Health*, *13*(6), 846-852.

Papers included in the meta-analysis about compliance

† Barnett, P., Soresen, J., Wong, W., Haug, N., & Hall, S. (2009). Effect of incentives for medication adherence on health care use and costs in methadone patients with HIV. *Drug and Alcohol Dependence*, 100, 115-121.

† Diaz, S., & Perez, J. (2009). Use of small incentives for increasing participation and reducing dropout in a family drug-use prevention program in a Spanish sample. *Substance Use & Misuse*, 44(14), 1990-2000

† Grady, K., Goodenow, C., & Borkin, J. (1988). The effect of reward on compliance with breast self-examination. *Journal of Behavioral Medicine*, 11(1), 43-57.

† Low, N., McCarthy, A., Macleod, J., Salisbury, C., Campbell, R., Roberts, T., Horner, P., Skidmore, S., Sterne, J., & Egger, M. (2007). Epidemiological, social, diagnostic and economic evaluation of population screening for genital Chlamydial infection: Overview of the Chlamydia Screening Studies project (pp. 7-13). *Health Technology Assessment*, 11(8), 164 pages.

†Lund, A., Kegeles, S., Weisenberg, M. (1977). Motivational techniques for increasing acceptance of preventive health measures. *Medical Care*, 15(8), 678-692.

†Malotte, C., Rhodes, F., & Mais, K. (1998). Tuberculosis screening and compliance with return for skin test reading among active drug users. *American Journal of Public Health*, 88(5), 792-796.

†Malotte, C., Hollingshead, J., & Rhodes, F. (1999). Monetary versus nonmonetary incentives for TB skin test reading among drug users. *American Journal of Preventive Medicine*, 16(3), 182-188.

†Malotte, C., Hollingshead, J., & Larro, M. (2001). Incentives vs. outreach workers for latent TB treatment in drug users. *American Journal of Preventive Medicine*, 20(2), 103-107.

†Malotte, C., Ledsky, R., Hogben, M., Larro, M., Middlestad, S., Lawrence, J., Olthoff, G., Settlage, R., van Devanter, N., & GCAP Study Group (2004). Comparison of methods to increase repeat testing in persons treated for gonorrhea and/ or Chlamydia at public sexually transmitted disease clinics. *Sexually Transmitted Diseases*, 31(11), 637-642.

†Moran, W., Nelson, K., Wofford, J., Velez, R., & Case, L. (1996). Increasing influenza immunization among high-risk patients: Education or financial incentive? *American Journal of Medicine*, 101, 612-620.

†Parrish, J., Charlop, M., & Fenton, L. (1986). Use of a stated waiting list contingency and reward opportunity to increase appointment keeping in an outpatient pediatric Psychology clinic. *Journal of Pediatrics*, 11(1), 81-89.

†Pilote, L., Tulsky, J., Zolopa, A., Hahn, J., Scheter, G., & Moss, A. (1996). Tuberculosis prophylaxis in the homeless: A trial to improve adherence to referral. *Archives of Internal Medicine*, 156, 161-165.

†Reiss, M., Piotrowski, W., & Bailey, J. (1976). Behavioral community Psychology: Encouraging low-income parents to seek dental care for their children. *Journal of Applied Behaviour Analysis*, 9, 387-397.

†Reiss, M., & Bailey, J. (1982). Visiting the dentist: A behavioral community analysis of participation in a dental health screening and referral program. *Journal of Applied Behavior Analysis*, 15, 353-362.

†Slater, J., Henly, G., Ha, C., Malone, M., Nyman, J., Diaz, S., & McGovern, P. (2005). Effect of direct mail as a population-based strategy to increase mammography use among low-income underinsured women ages 40 to 64 years. *Cancer Epidemiology Biomarkers Prevention*, 14(10), 2346-2352.

†Stevens-Simon, C., Dolgan, J., Kelley, L., & Singer, D. (1997). The effect of monetary incentives and peer support groups on repeat adolescent pregnancies: A randomized trial of the dollar-a-day program. Obstetrical & Gynecological Survey, 52(9), 545-546.

† Stitzer, M., Polk, T., Bowles, S., & Kosten, T. (2010). Drug users' adherence to a 6-month vaccination protocol: Effects of motivational incentives. *Drug and Alcohol Dependence*, 107, 76-79.

†Tulsky, J., Pilote, L., Hahn, J., Zolopa, A., Burke, M., Chesney, M., & Moss, A. (2000). Adherence to isoniazid proohylaxis in the homeless: A randomized controlled trial. *Archives of Internal Medicine*, 160, 697-702.

†White, M., Tulsky, J., Reilly, H., Hoynes, T., & Goldenson, J. (1998). A clinical trial of a financial incentive to go to the tuberculosis clinic for isoniazid after release from jail. *International Journal of Tuberculosis Lung Disease*, 2(6), 506-512.

†Yokley, J., & Glewick, D. (1984). Increasing the immunization of preschool children: An evaluation of applied community interventions. *Journal of Applied Behavior Analysis*, 17, 313-325.

Appendix 1: Search Strategy for the review about blood donation[9]

[9] Search strategy was simplified in some databases due to limitations in the search engines

	MEDLINE	EMBASE	PsycInfo	CINAHL
Financial incentives	Monetary incentive Financial incentive Reimbursement incentive (su) Physician incentive plans (su) Incentive* Reward (su) Monetary* Cash Lottery Compensa* Pay* Sell* Financ* Remunera*	Incentives Monetary Incentive* Financial incentive* Rewards (su) Incentive* Cash Monetary* Lottery Compensation (su) Compensation Lottery Pay* Sell* Remunera*	Incentives (su) Monetary incentives (su) Financial incentive (kw) Rewards (su) Monetary rewards (su) Rewards (kw) Cash (kw) Monetary* (kw) Lottery (kw) Compensation (kw) Pay* Sell* Finance* Remunera*	Physician incentive plans (su) Incentive* Finance* Monetary* Lottery Cash Reward Reward (su) Compensation Pay* Sell* Remunera*
Blood	Blood donors (su) Blood don* Paid blood* Money for blood Blood tansfusion (su)	Blood don* Morey for blood Paid blood donation Blood donation Blood donor su	Blood don* Blood trans* Money for blood Paid blood donation	Blood for money Paid blood donation Blood don* Blood donors (su) Blood transufion (su) Exchange transfusion (su) Whole blood (su)

Appendix 2: Search strategy for the review about compliance [10]

[10] Search strategy was simplified in some databases due to limitations in the search engines

Health Care Compliance

•Medical adherence OR medical nonadherence OR medical non-adherence
•Medical compliance OR medical noncompliance OR medical non-compliance
•Medical concordance OR medical nonconcordance OR medical non-concordance
•Medication concordance OR medication nonconcordance OR medication non-concordance
•Medication persistence OR medication nonpersistence OR medication non-persistence
•Medical *near/ within2* (adher$ OR comply$ OR persist$ OR follow$ OR conclusion OR conclude$ OR finish$ OR terminat$ OR stick$ OR continu$ OR accept$ OR concord$ OR taking OR dropout OR stop$ OR quit$ OR leav$ OR reduc$ OR attend$ OR participat$ OR enroll$ OR maintain$ OR retention OR retain$)
•Treatment *near/ within2* (adher$ OR comply$ OR persist$ OR follow$ OR conclusion OR conclude$ OR finish$ OR terminat$ OR stick$ OR continu$ OR accept$ OR concord$ OR taking OR dropout OR stop$ OR quit$ OR leav$ OR reduc$ OR attend$ OR participat$ OR enroll$ OR maintain$ OR retention OR retain$)
•Medication *near/ within2* (adher$ OR comply$ OR persist$ OR follow$ OR conclusion OR conclude$ OR finish$ OR terminat$ OR stick$ OR continu$ OR accept$ OR concord$ OR taking OR dropout OR stop$ OR quit$ OR leav$ OR reduc$ OR attend$ OR participat$ OR enrol$ OR maintain$ OR retention OR retain$)
•Immunisation OR immunization OR vaccine OR vaccination
•Attendance *near/ within2* (visit OR appointment)
•Preventive visit
•Refill OR pill count
•Screening
•Appointment *near/ within2* (doctor OR medica$ OR pregnancy OR keep$ OR mak$ OR maintain$)
•Health promotion
•Health services *near/ within 2* (utilization OR utilization OR use OR uptake)
•Medical services *near/ within 2* (utilization OR utilization OR use OR uptake)
•Abstinence

Incentive

•Reward OR Payment OR Prize OR Award OR Cash transfer OR Monetary OR Economic OR Token economy OR Raffle OR Contingency management OR Lottery OR lotteries OR Coupon OR Gift OR Incentive OR Reinforcement OR Compensation OR Recompense OR Competition OR Contest OR Bonus OR Contingent pay OR Endowment
•Motivat$ OR Inducement OR Induc$ OR Reinforc$ OR Compensat$ OR recompensat$
•Reimbursement OR Refund OR Repay$
•Punishment OR Loss OR Cost OR Deposit contract OR Disincentive OR Penalty OR penal$ OR Sanction OR Fine OR Punish$ OR Reimburs$ OR Free OR Reduc$ cost OR Reduc$ price OR copay$ OR co-pay$ OR "cost sharing"

Research Design

•Randomized controlled trial OR Rct OR Quasi-randomized controlled trial OR Pseudorandomized controlled trial OR Randomised controlled trial OR Quasi-randomised controlled trial OR Pseudorandomised controlled trial OR Pct OR Clinical controlled trial OR Cct OR Experiment OR Evaluation OR Intervention OR Empirical OR Assessment OR Quantitative OR Quantification OR Quantify OR Random allocation OR Test

Appendix 3: Invitation Leaflets for the Chlamydia study

Have you ever had sex?
Are you under 24?

If so, there is **one in ten** chance that you have Chlamydia.

Chlamydia is one of the **most common** sexually transmitted infections. Most men and women who have Chlamydia don't know they have it.

If left untreated, Chlamydia **can cause** fever, painful urination, eye diseases and infertility.

But it is **really easy** to treat with antibiotics. Find out if you have it by taking a simple do-it-yourself test.

Tomorrow and the next day there will be tests available in the **reception** for you to pick up.

There are **instructions** inside the test on how to do it. If you have any doubt, there will be a person in the reception to explain and help you.

The Chlamydia test is **free** and **confidential**. If you have ever **had sex** and are **24 years old or younger** please pick up a test in the next few days.

You **will gain** a **£5 HMV** voucher if you take the test

Gain-framed incentive offer of the £5 voucher

Have you ever had sex?
Are you under 24?

If so, there is **one in ten** chance that you have Chlamydia.

Chlamydia is one of the **most common** sexually transmitted infections. Most men and women who have Chlamydia don't know they have it.

If left untreated, Chlamydia **can cause** fever, painful urination, eye diseases and infertility.

But it is **really easy** to treat with antibiotics. Find out if you have it by taking a simple do-it-yourself test.

Tomorrow and the next day there will be tests available in the **reception** for you to pick up.

There are **instructions** inside the test on how to do it. If you have any doubt, there will be a person in the reception to explain and help you.

The Chlamydia test is **free** and **confidential**. If you have ever **had sex** and are **24 years old or younger** please pick up a test in the next few days.

You **will gain** **the chance to win a** **£200 HMV** voucher if you take the test

Gain-framed incentive offer of the £200 voucher lottery

Have you ever had sex?
Are you under 24?

If so, there is **one in ten** chance that you have Chlamydia.

Chlamydia is one of the **most common** sexually transmitted infections. Most men and women who have Chlamydia don't know they have it.

If left untreated, Chlamydia **can cause** fever, painful urination, eye diseases and infertility.

But it is **really easy** to treat with antibiotics. Find out if you have it by taking a simple do-it-yourself test.

Tomorrow and the next day there will be tests available in the **reception** for you to pick up.

There are **instructions** inside the test on how to do it. If you have any doubt, there will be a person in the reception to explain and help you.

The Chlamydia test is **free** and **confidential**. If you have ever **had sex** and are **24 years old or younger** please pick up a test in the next few days.

You **will lose** a **£5 HMV** voucher

if you don´t take the test

Loss-framed incentive offer of the £5 voucher

Have you ever had sex? Are you under 24?

If so, there is **one in ten** chance that you have Chlamydia.

Chlamydia is one of the **most common** sexually transmitted infections. Most men and women who have Chlamydia don't know they have it.

If left untreated, Chlamydia **can cause** fever, painful urination, eye diseases and infertility.

But it is **really easy** to treat with antibiotics. Find out if you have it by taking a simple do-it-yourself test.

Tomorrow and the next day there will be tests available in the **reception** for you to pick up.

There are **instructions** inside the test on how to do it. If you have any doubt, there will be a person in the reception to explain and help you.

The Chlamydia test is **free** and **confidential**. If you have ever **had sex** and are **24 years old or younger** please pick up a test in the next few days.

You **will lose the chance to win a £200 HMV** voucher if you take the test

Loss-framed incentive offer of the £200 voucher lottery