Applying behavioural insights to challenges in health policy

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'It turns out that the environmental effects on behaviour are a lot stronger than most people expect'

Daniel Kahneman, 2008

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Abstract

Many of the more significant challenges we face in healthcare - such as reducing smoking, encouraging exercise and improving clinician adherence to evidence-based guidelines - will only be resolved if we are more successful at changing behaviours. The traditional tools used when thinking about influencing behaviour include legislation, regulation and information provision. Recently, interest has been shown in policies that 'nudge' people in particular directions; drawing on major advances in our understanding that behaviour is strongly influenced (in largely automatic ways) by the context and situation within which it is placed.

Insights from across the behavioural sciences and particularly behavioural economics provide us with a powerful set of new and refined policy tools to use when trying to influence health-related behaviours. My thesis - 'Applying behavioural insights to challenges in health policy' - considers the theoretical basis for why 'nudges' might work and presents the Mindspace framework (that I co-developed with colleagues) that supports policy makers and practitioners looking to apply behavioural insights. Mindspace sets out what are considered to be the most robust effects on behaviour that operate largely, though not exclusively on automatic neurobiological and psychological systems. I explore the evidence for each of the Mindspace effects and demonstrate how they can be applied to specific areas of challenge including in enhancing the safety of medication prescribing, improving hand-hygiene compliance and reducing the trajectory of health spending in developed health systems. I do so through a mixture of qualitative and quantitative approaches, at all times grounding the work in the practicalities of my experience as a clinician.

I explore the ethical and political considerations in determining whether it is appropriate to target automatic processes of judgment and make suggestions as to the direction of travel of 'nudging' in health policy going forward, particularly in relation to new information and communication technologies.

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Statement of contribution

The work presented in this thesis is my own. Much of this work however has been supported or carried out in collaboration with colleagues and where this is the case, this has been appropriately referenced. In particular, I received direction and support from the following colleagues;

Professor Paul Dolan and Professor Ara Darzi provided strategic direction throughout my thesis.

The development of the Mindspace framework was a collaborative effort between Paul Dolan, David Halpern, Ivo Vlaev, Michael Hallsworth, Robert Metcalfe and myself. I took part in all stages of its development with a particular focus on the literature review and the case studies used. In writing the original report I took specific responsibility for particular sections, many of which are expanded on in this thesis. I did take part in any of the formal interviews with key opinion leaders undertaken as part of Mindspace and do not refer directly to the content of these in my thesis.

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Some of the issues around using behavioural insights in public policy explored in Chapter 10 derived from a submission made by Paul Dolan, Ivo Vlaev and myself to the House of Lords select committee that I had coordinated.

Notes on work published elsewhere

Elements of my thesis have been published in the following journals and reports. A fuller list of publications that I contributed to over the course of my thesis are documented in Chapter 12.

Articles

- King D, Vlaev I, Darzi A, Birnbach D. Priming hand hygiene compliance in clinical environments. Accepted at Health Psychology (April 2015)
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- Dolan P, Hallsworth M, Halpern D, King D, Vlaev I (2010). Mindspace: Influencing behaviour through public policy, London, Institute for Government & the Cabinet Office
- Dolan P, King D, Metcalfe R, Vlaev I (2010). House of Lords Science and Technology Committee on Behaviour Change. Written Evidence

List of abbreviations

BIT	Behavioural Insights Team
CAHPS	Consumer Assessment of Healthcare Providers and Systems
CHW	Community health workers
CQC	Care Quality Commission
BMJ	British Medical Journal
GPS	Global Positioning System
HAI	Hospital acquired infections
HHC	Hand hygiene compliance
IDEAS	Imperial Drug Chart Evaluation and Adoption Study
ICL	Imperial College London
IFG	Institute for Government
LMIC	Low and middle income countries
LSE	London School of Economics
MMS	Multimedia messaging service
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
OECD	Organization for Economic Co-operation and Development
RCA	Royal College of Art
RCT	Randomised Controlled Trial
SMS	Short messaging service (text message)
UK	United Kingdom
USA	United States of America
QOL	Quality of Life

Executive summary

Through ‘applying behavioural insights to challenges in health policy’, my PhD thesis explores how the latest insights into human decision-making can help to deliver more effective health policy. For people working in healthcare, behaviour change should not be a new concept. Whether it is trying to reduce smoking rates or supporting the effective implementation of evidence-based guidelines, policymakers, health managers and health professionals are in the business of behaviour change.

The consequences and costs of suboptimal decision-making in healthcare are substantial. A large proportion of the years of healthy life lost worldwide relate to the individual choices people make, with up to half of all deaths in developed countries attributable to health-related choices (e.g. smoking, diet, exercise and alcohol use). Diseases with strong behavioural components are also becoming more common in low and middle income countries (1, 2). On the provider side, the substantial challenges we face in improving healthcare delivery and controlling healthcare expenditure also involve a strong behavioural component (3).

By observing real life choices, functional brain imaging and carefully controlled experiments, people are shown to predictably deviate from the rational models of decision-making that have dominated existing behaviour change frameworks. Many existing interventions have sought to influence decision-making by encouraging people to reflect on the choices available to them. But advances in the behavioural sciences and particularly behavioural economics have presented policy makers with new tools to influence behaviour that take account of the finding that a substantial proportion of human behaviour is automatic.

Behavioural economics which combines insights from both psychology and economics demonstrates that behaviour is strongly influenced by environmental or contextual factors and subject to social influences, cognitive biases and the format in which choices are presented. Work

by behavioural scientists has highlighted the powerful role of the environment or context in shaping behaviour. Our decision making can be seen to be predictably influenced by alterations in the 'choice architecture', as Thaler and Sunstein call it in their influential book *Nudge: Improving Decisions about Health, Wealth, and Happiness* (4). Simply put, choice architecture is the context or environment in which choices are presented. The book *Nudge* begins with the illustration of a manager of a school cafeteria who discovers how students food choices can be influenced by the way in which foods are arranged and displayed. How that manager presents or arranges the choices is choice architecture. The term 'nudge' is used to describe any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives (4).

Policies that change the context or 'nudge' people in particular directions have captured the imagination of policymakers at the same time as the limitations of traditional approaches to changing behaviour have become apparent. The UK Government led by David Cameron has stated their intention to use more 'intelligent ways' to change behaviour and have focused attention on non-regulatory interventions and in particular, on the concept of behavioural public policy (5).

Although popularised in *Nudge,* the theory underpinning many behavioural policy suggestions are built on decades of research in the behavioural sciences by academics such as Robert Cialdini, Dan Ariely, Richard Thaler, George Lowenstein, Amos Tversky and the Daniel Kahneman (4, 6-10). Popular and accessible books such as *Predictably Irrational, Influence, Yes* and *Thinking, Fast and slow* have been published alongside highly cited peer-reviewed academic publications and reports. Daniel Kahneman, the father of modern behavioural economics, was awarded the Nobel Prize in Economics in 2002 for the work he did with Amos Tversky in demonstrating that people do not always make decisions based on a rational, utility maximising processes (11).

By recognising that people reliably behave in specific situations, policy makers and practitioners can design policies that go with the 'automatic' grain of human behavior rather than against it. In this way, the same errors that cause people to trip people up, can be used to help them make better and more effective choices. A prominent example is the default option for new employees to be enrolled in company pension schemes. A nudge that encourages pension enrolment may be to automatically enrol new employees into the scheme rather than expect them to actively choose to do so. Automatic enrolment, with an opt-out option if a person decides not to participate, takes advantage of people's tendency to favour the default or pre-set option. When enrolment is presented as the default, a greater percentage of people are seen to participate in retirement savings plans than when the default is not enrolling (12). With evidence of the effectiveness of default opt out policies in pensions and savings decisions, a number of governments (including in the UK) have recently implemented such policies with substantial success (13).

While insights from the behavioural sciences have been widely used across financial services, retail and other sectors to influence what we buy, how we invest, and other aspects of our behaviour, the design of health services and interventions remains relatively unaffected by the enhanced understanding we now have of human judgement and decision-making. This is the gap my thesis aims to tackle.

To better explore the role of behavioural dimensions of health policy, my thesis is split into three broad parts. The early chapters of my thesis set out to explore the underlying reasons why decisions made on the part of patients and the public, healthcare providers (e.g. doctors and nurses) and policy makers are often suboptimal.

In **Chapter 1,** I provide a view of decision making that views humans broadly moving between two information processing systems. System 1 (automatic system) processes are fast, unconscious, intuitive and affective, whilst System 2 (reflective system) processes are slow, conscious, reflective

and rational. The presence of two different operating systems suggest that there are two routes to behaviour change. The former focussed on the more automatic processes of judgment and influence and the latter based on influencing what people consciously think about.

In **Chapter 2,** I explore behaviour change frameworks in wide use in academia and/or policy making and define the Mindspace framework for behaviour change, which I co-developed with colleagues (Paul Dolan, David Halpern, Michael Hallsworth, Robert Metcalfe and Ivo Vlaev). Mindspace represents our attempt at producing a robust, but digestible framework for policy makers and practitioners to use. Dozens of behaviour change frameworks have been proposed and used, with Mindspace representing an attempt to combine a level of rigour with something that could be easily used on the ground. Mindspace presents a summary categorisation of a body of (largely contextual) effects on behaviour that have been observed in both experimental and real world setting, captured in a simple mnemonic. The Mindspace effects (messenger, incentives, norms, defaults, salience, priming, affect, commitment and ego) all have good evidence supporting their effectiveness and can be used to think not only about why people make irrational or suboptimal decisions but also how behavioural insights can be used to deliver more effective behaviour change. In **Chapter 3** I look at the evidence for Mindspace specifically in the health domain, providing policy suggestions where appropriate.

The second part of my thesis follows on from the finding that behavioural theory has the potential to improve existing behaviour change tools as well as suggest new and potentially more effective ways that public policy can shape behaviour. I demonstrate how Mindspace and wider behavioural insights can be applied to specific policy challenges including in ;

- Reducing the trajectory of healthcare spending, a major issue in almost all developed health systems (in **Chapter 4**).

- Improving the quality and safety of medication prescribing in hospitals where we see approximately 10% of all medication orders in the NHS contain some type of error (in **Chapter 6**)
- Encouraging hand-hygiene in clinical environments where the consequences of poor hand hygiene compliance can be life threatening infections (in **Chapter 7)**
- How new communication technologies including social media can be used as both a lens into human behaviour as well as a delivery vehicle for interventions (In **Chapter 8 and 9**)

A range of research methods incorporating both qualitative and quantitative strategies have been used in the work presented in this thesis. I have used a framework throughout this work called the '6 E's that was presented in the Mindspace report and can be used when designing, implementing and evaluating behavioural interventions (explored more fully in **Chapter 5**).

The third and final part of my thesis explores some of the issues about using subtle but often powerful approaches to changing behaviour, which have the the potential to attract public controversy. Concerns exist not just about the efficacy of nudge type policies - some behavioural researchers argue that the effects of 'nudge' are rather marginal and short lived - but also about how nudging can interfere with autonomy and personal liberty. In **Chapter 10** I discuss issues around personal responsibility, public permission and distributional concerns. These topics have received substantial attention as part of a recent inquiry into behaviour change interventions led by House of Lords Science and Technology Sub-committee (under the chairmanship of Baroness Neuberger) and in the popular press where 'nudging' can be seen as manipulative and a form of 'subliminal mind-control' (5). In **Chapter 11** I finish with overall conclusions to my thesis and provide some notes on areas where my research has taken me to.

The application of behavioural insights to health and public policy has come a long way over the course of completing this thesis. A *Behavioral Insights Team* now advises the British Prime Minister, and key members of President Barack Obama's administration (such as Peter Orszag and Cass Sunstein) have been prominent devotees of behavioral economics. In the health domain, the Coalition Government's 2012 public health white paper promised that the government would explore 'nudging people in the right direction rather than banning or significantly restricting choices'. In the latter part of 2013, the Department of Health established a *Behaviour Change Unit* that like its counterpart in the Cabinet Office was charged with enhancing policy making using behavioural insights.

I have been fortunate to be part of the team that developed the Mindspace framework, and saw its publication as a report from the Cabinet Office, published midway through my PhD. Mindspace has served as an organising framework for applying behavioural insights across the public and private sectors. I have contributed to the work of both the *Behavioural Insights Team* at the Cabinet Office and the *Behaviour Change Unit* at the Department of Health and as a consequence have seen the challenges and benefits of incorporating behavioural theory into public policy.

When you consider almost every important choice in healthcare, it becomes apparent that most do not have a neutral option and as such policy-makers and health professionals will be influencing behaviour all the time through choice architecture. The way a treatment option is presented, how information is delivered or how an incentive scheme is structured will determine its impact. My thesis aims to provide an account of how behavioural insights can be used to think about the choice environment in healthcare.

The Mindspace effects

MINDSPACE cue	Behaviour
Messenger	we are heavily influenced by who communicates information to us
Incentives	our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses
Norms	we are strongly influenced by what others do
Defaults	we ‘go with the flow’ of pre-set options
Salience	our attention is drawn to what is novel and seems relevant to us
Priming	our acts are often influenced by sub-conscious cues
Affect	our emotional associations can powerfully shape our actions
Commitments	we seek to be consistent with our public promises, and reciprocate acts
Ego	we act in ways that make us feel better about ourselves

Chapter 1

1. Changing behaviour by changing contexts

Summary

Rational choice theory has been widely used as an assumption of human behaviour in microeconomic models and analysis and has also been very influential when thinking about the design of policy interventions. The last decade has brought an enhanced understanding of wider influences on behaviour, with these insights challenging the dominance of standard economic models and the 'rational' or 'reflective' paradigm in general.

Substantial evidence from psychological and neurobiological research has suggested that people move broadly between two categories of behaviour. Dual process models categorise System 1 (automatic system) processes as being fast, unconscious, intuitive and affective, whilst System 2 (reflective system) processes are slow, conscious, reflective and rational. System 1 processes that require little or no cognitive engagement allow individuals to cope with the complexity inherent in many everyday choices (what tie to wear, how to get to work, what to have for lunch). By using heuristics (mental short-cuts), full information processing requirements are bypassed, making decisions easier. Although heuristics are undoubtfully helpful in problem solving, under conditions of complexity these same automatic 'rules of thumb' can also lead people into systematic biases and errors.

In addition to dual process models helping us to better understand decision-making, the two different operating systems suggest that there are two different routes to changing behaviour, the former focussed on the more automatic processes of judgment and influence and the latter based on influencing what people consciously think about. Many traditional approaches to changing behaviours in healthcare depend on engaging System 2 and are designed to alter an individuals

beliefs and attitudes. For many health-related policy challenges (e.g. reducing smoking or encouraging medication adherence), existing approaches have only been moderately successful at positively changing behaviour. An enhanced understanding of System 1 processes provides us with opportunities of influencing choices that take better account of how people actually respond to the context within which their decisions are made. The same errors that trip people up could also be used to help them make better choices by altering contextual cues to prompt better choices.

This first chapter explores dual process theory as it serves as the theoretical backbone of nudge type interventions and helps to explain why people shift between two broad categories of behaviour and why new approaches to intervention design are necessary.

Introduction

The neoclassical economic model of individual decision making emphasises rationality. Rational choice theory is a framework for understanding and modelling human decision making that assumes that decisions are reached as a consequence of individuals weighing up the utility or costs and benefits of each decision. Rationality is widely assumed in almost all economic textbooks treatment of human judgment and decision making with individuals presumed to make choices to maximise a utility function by processing the available information appropriately.

A large proportion of existing behavioural interventions in public policy are premised on rational choice theory and rely on influencing the way people consciously think about their behaviour. By changing people's motivations and intentions it is expected that their behaviour will change accordingly. The problem is that a substantial proportion of the variance in behaviour is unaccompanied by conscious reflection and not easily explained by intentions. Several recent meta-analyses imply that changing intentions would account for less than one-third of the variance in behaviour change, and estimates based on experimental or causal studies report explained variance as low as 3% (14, 15).

The presumption of rationality in decision-making has been widely challenged including by the Nobel Laureate Herbert Simon who introduced the concept of 'bounded rationality' which represented an early attempt to incorporate cognitive limitations into economic models. Bounded rationality is the idea that rationality is constrained by the information people have, the time they have to make decisions and limited cognitive processing abilities (16). Further laboratory and field experiments have further questioned the assumptions of the core idea of rational choice (17). This has led to a burgeoning literature on behavioural economics that has integrated psychological understanding of decision-making into existing economic framework.

Although standard and behavioural economics may be interested in the same important questions, behavioural economics (and associated disciplines) does not assume that people are rational. Behavioural science has demonstrated that decision making predictably deviates from that assumed by standard economic theory, with behaviour being influenced by the context or environment in which many choices are made (10, 18). The discrepancies between the rational actor model of decision-making assumed in microeconomic analysis, and how people actually make decisions are termed cognitive errors or defects. The term 'context' which is used throughout my thesis refers to the overall environment of the choice and this could be 'associated with the physical environment, the people or culture around the decision-makers, or the information delivered during the choices' (19).

A detailed approach to decision-making advanced in recent years by psychologists and behavioural economists can be described through dual process theories or frameworks of behaviour (20). These models go beyond rational accounts of human behaviour to include emotions and heuristics as determinants and help to better understand and explain human behaviour. 'Dual process' models explain how people shift between two broad categories of behaviour and are often used to provide a theoretical basis for targeting automatic behaviours with 'nudges' (18, 21). These frameworks also help to explain a range of phenomena discussed in my thesis such as loss aversion, intertemporal choice and altruism (20).

The dual-process approach to understanding behaviour

In broad terms, psychologists and neuroscientists have converged on a description of brain functioning that is based on two qualitatively different types of cognitive processes, also interpreted as two distinct systems: evolutionarily older 'System 1' (the automatic system) processes that are quicker and less effortful and are described as automatic, uncontrolled, effortless, associative, unconscious and affective, and more recent, characteristically human 'System 2' (the reflective

system) processes involving lots of conscious, deliberate effort which is described as being controlled, effortful, rule-based, slow, and rational and draws on the individual's knowledge of values and probabilities (see Figure 1.1) (22, 23). Although there are different variants of the two modes, there is general agreement that System 1 is based on heuristics and affect and System 2 on more deliberative, systematic reasoning (24).

So on the one hand we act in a reflective manner, consciously weighing up our motivations and goals alongside the perceived outcomes of any decision. On the other, we make choices outside of conscious reflection, responding automatically to the environment or context in which the decision takes place (25). These ideas are not new and can be traced back to James and Freud's distinctions between reasoning being analytic/experiential and conscious/unconscious but recent neurobiological evidence of separate brain structures for automatic processing of information provides substantial support to these dual process models (24, 26).

There are benefits and disadvantages of both types of information processing and neither System 1 or System 2 should be regarded as necessarily 'good' or 'bad'. In many circumstances it will certainly pay to slowly and deliberately think about different choices and outcomes but doing so in routine and familiar situations is cumbersome and inefficient. In a clinical setting, System 1 decision making can provide life-saving decisions very quickly (e.g. a clinician's arrival at a quick diagnosis and treatment plan in emergent but familiar situations) but may not provide the right answers when facing an unfamiliar or complex problem. System 2 can use complex information to solve a challenging clinical problem or calculation when System 1 processes are incapable of doing so but does not provide an efficient way of handling the hundreds of different decisions a clinician makes every day (27). In practice of course, the distinction between System 1and System 2 is not so clear cut. A mix of both reflective and automatic processes will govern behaviour although the two can come into conflict. Marteau and colleagues suggests that it is useful to think about the dual

process model in terms of a balance, with certain factors promoting the more reflective and others the more automatic behaviours (25).

Figure 1.1: Features of System 1 and 2 processes

System 1: automatic	System 2: reflective
Theoretical labels	
Heuristic Associative Experiential	Analytic Rational Rule-based
Features	
Fast Unconscious Uncontrolled Intuitive Affective Spontaneous Qualitative	Slow Conscious Controlled Effortful Systematic Logical Quantitative
Examples of use	
Taking the daily commute Speaking in mother tongue	Planning an unfamiliar journey Speaking a second language

It is the more human System 2 that has dominated the frameworks that are in popular use to understand behaviour. In contrast, System 1 processes have been relatively ignored to date despite the finding that much of our decision-making is ruled by automaticity (18). The limitations of System 2 are associated with *bounded rationality,* where deliberate and rational decision making is hampered by lack of time, knowledge and computational capacity (28). System 1 processes respond to these constraints by using a number of simplifying rules of thumb, known as decision-making heuristics. Using these shortcuts bypasses full information processing requirements, allowing people to make decisions more efficiently. For the most part these rules of thumb work well, but by

removing awareness and reflection, these automatic processes can lead people into cognitive biases and predictable errors that distort 'rational' decision-making processes. Kahneman and Tversky devised a series of widely cited experiments which identified situations in which heuristics violated the axioms of rational choice and published them in a series of landmark academic publications (9, 29, 30).

Familiar real world examples of heuristics that may lead to suboptimal choices include taking price as an indicator of quality or assuming that bigger or more is better. In clinical contexts, these mental shortcuts can lead to excessive diagnostic testing and a preference for new and expensive diagnostics that are unnecessary and/or not cost-effective (3). The ability to process information and make good decisions using these heuristics can be hampered by features like stress and fatigue, disturbances of sleep and high emotions that are also common in clinical contexts or other high pressure environments (27).

Behavioural scientists have identified dozens of heuristics and their related cognitive biases such as those stemming from emotion, preconceptions, availability of information, tendencies toward action or inaction, and aversions of various kinds (see Figure 1.2 for some examples). These automatic drivers of behaviour can put people out of touch with their conscious desires, leading to suboptimal decision-making and costly consequences.

Two different routes to behaviour change

The existence of two different processing systems operating in the brain suggests two different routes to changing behaviour. We can attempt to influence what people consciously think about (through system 2) or alternatively we can target more automatic processes of judgment and influence (system 1).

Figure 1.2: Examples of comon behavioural heuristics and biases

Heuristic	Description
Anchoring effect	Tendency to rely too heavily in making decisions on one ‘anchoring’ trait or piece of information (29). This can influence the way an individual intuitively assess probabilities
Availability heuristic	Tendency to only consider information important or relevant if it comes to easily to mind (253)
Attention bias	The tendency to neglect relevant data when making judgments of a correlation or association
Confirmation bias	Tendency to search or interpret information that confirms existing thoughts or impressions
Endowment effect	Tendency to demand more for an object they have rather than acquire it
Focusing effect	Tendency to place too much importance on a specific aspect of an event
Framing effect	Finding that people draw different conclusions from the same information depending on how it is presented to the recipient (30)
Hyperbolic discounting	Tendency to prefer more immediate pay-offs to later pay-offs (73)
Loss aversion	The costs of giving up an object are higher than the utility associated with acquiring it
Omission bias	Tendency to judge harmful actions as worse than equally harmful omissions or inactions. This can lead to inaction
Representativeness bias	Tendency to judge probability of a hypothesis by considering how much the hypothesis represents available data as opposed to using probability based calculations (4)
Status quo bias	Tendency to prefer things to stay the same. The current baseline or status quo is taken as a reference point with any move away from this perceived as a loss

Targeting System 2 processes can be called the ‘rational’ or ‘cognitive’ approach. Most recent models of population-wide behaviour change have focussed on changing cognitions through reflective processing: if we can change the way people think (their goals, attitudes etc) then we can change the way they behave. Such interventions typically focus on providing new information, which seeks to change the way people think about their behaviour, or different incentives, which changes the way they think about the consequences of their behaviour. Incentives can be financial or non-financial with economists typically thinking about bringing about changing behaviour through price signals. If the price of something we desire increases, we will usually buy less of it. Approaches based on providing information or incentives (targeting System 2 processes) are the basis for many if not the majority of interventions currently used to change health-related behaviours, despite a lack of strong evidence confirming effectiveness more generally (31).

The contrasting model of behaviour change focuses on more automatic processes of judgment and influence and might be called the ‘context’ model of behaviour change. The context model recognises that that people are sometimes seemingly irrational and inconsistent in their choices, often because surrounding factors influence them. Therefore, it focuses more on changing contextual cues and changing behaviour without necessarily changing minds. This approach has untapped potential given that - as Nobel Laureate Daniel Kahneman has said - ‘it turns out that the environmental effects on behaviour are a lot stronger than most people expect’ (32).

To illustrate just how much the automatic processing context can affect our decision making, we can consider the impact default settings – the option that is pre–selected if the individual does not make an active choice – affect behaviour. Across many different domains if the default is to opt–in, very few people choose to opt–out; if the default is to opt–out, then very few people choose to opt–in. We often do whatever the status quo even if this implies very different consequences. For example switching from an opt–in to an opt–out default has been seen to increase participation in a

pension plan by approximately 50% (33). It is simply not conceivable that all people given the choice of enrolling into a pension scheme suddenly changed their cognitions or saw their incentives differently. It is more likely that they behaved in an automatic way, because maintaining the status quo does not involve any activity. Psychologists have shown that giving up the status quo option automatically cues loss aversion, which makes losing the default loom larger than any potential gains from moving away from it (34). In other settings, defaults appear to have profound effects on behaviour including in relation to car insurance and consent to receive e–mail marketing (4). In the health domain, there are a number of examples of how default options can impact on important decisions (e.g., through an opt–out policy of routine pneumococcal vaccination of hospitalized patients and an opt-out system for consenting onto the organ donor register) (35).

Defaults are only one of many examples where the choice environment has a profound automatic impact on behaviour. For example, food choices are often a consequence of contextual factors such as position of items on a menu or on supermarket shelf (4, 36). Calories consumed can by influenced by the size of plates and other cutlery, because people's choices for serving size are automatically cued in relation to container size (37). There are similar examples of how changes in context can influence the choice to drink alcohol to excess, exercise, help patients take their medications on time and encourage attendance at out-patient clinics. Many of these are discussed in Chapter 3.

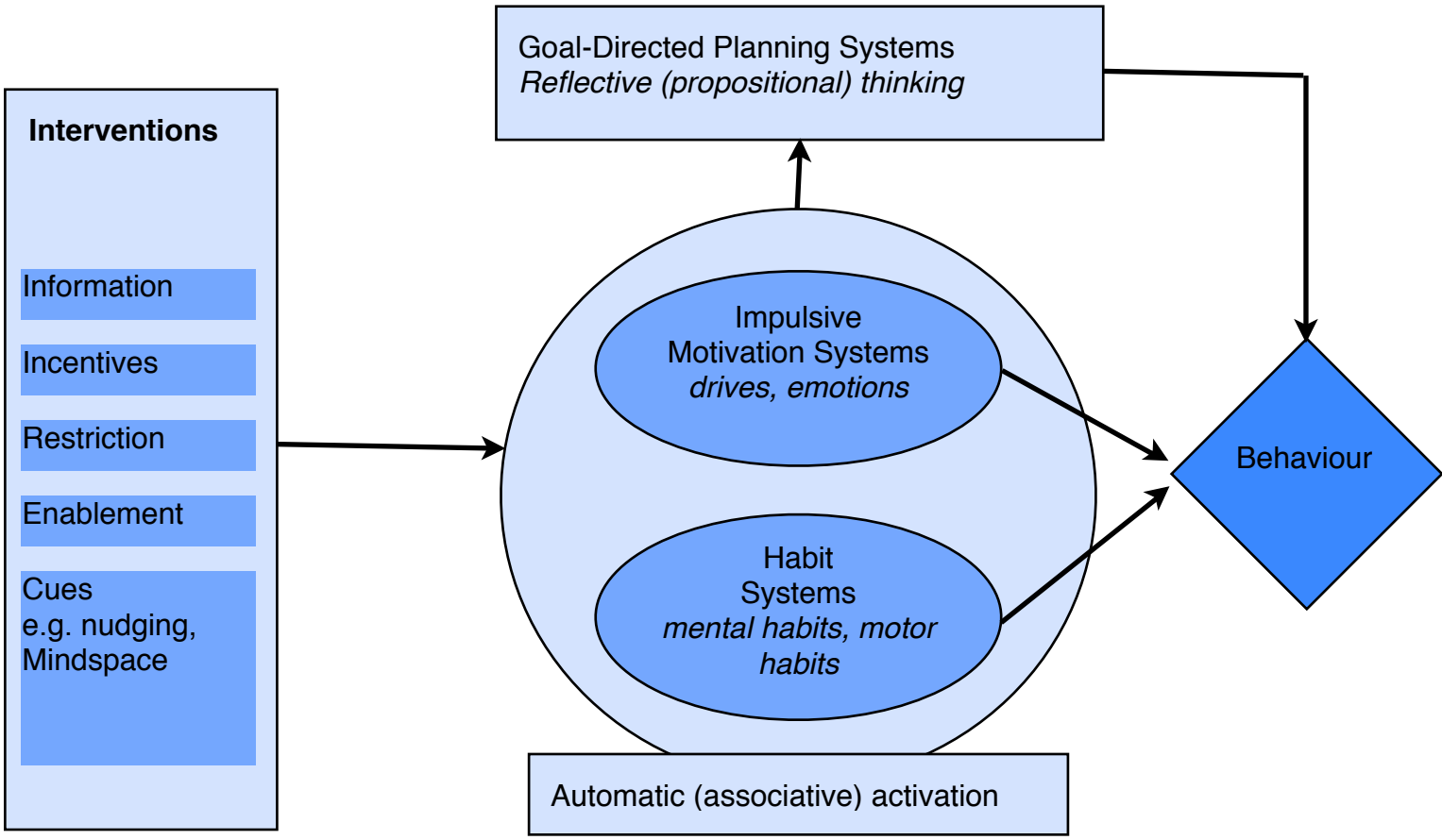
An enhanced understanding of the behavioural systems controlling behaviour

Dual process models of behaviour provide a simplified view of human decision-making. This simplicity allows difficult concepts to be more easily understood, helping to account for the popular appeal of bestselling books like *Thinking, Fast and Slow* and *Nudge* that have leaned heavily on these frameworks (4, 18). But concerns do exist about the the simple dichotomy of these models that may fail to fully capture the complexity of individual decision making.

A more sophisticated account of how reflective and automatic processing controls behaviour is provided through theoretical work by Ivo Vlaev (a close colleague and co-developer of Mindspace) with contributions from our wider team. In this model it is suggested that three core brain systems exist for behavioural control that can generate psychological processes (thoughts, drives, emotions, mental and motor habits) that go on to drive behaviour (see Figure 1.3) (38, 39).

In the model, reflective thought is embodied by the *goal-directed system* where people engage in model-based reasoning to achieve goals by weighing up different actions and possible outcomes. There are two distinct systems for automatic processing have been identified from recent integrative theories and reviews (39, 40). Firstly, the *habit [reflexive] systems*, is centred on learning through repeated practice in a stable environment, with value flexibly assigned to a variety of adaptive motor actions and mental operations and habits becoming established through repetition and routine with evidence of changes in individuals neurobiology (25, 41-43). This is likely to be the predominant system at play for a surgeon undertaking a routine operation that they have performed hundreds of times previously or a radiologists looking at their ten thousandth MRI scan. Whilst habits explain a significant part of automatic behaviour, it is not the only component. The *impulsive motivation system*, is based on evolutionarily acquired affective responses (e.g. disgust, attraction) that is elicited in response to a specific environmental stimuli (e.g., people, food) and which leads to a 'prepared' choice or behaviours (e.g. avoidance, consumption) (44, 45). Contextual or environmental cues can therefore unconsciously bring to mind a desire or elicit a habitual response (25).

Figure 1.3: Underlying regulatory process affecting behaviour



An enhanced understanding of the processes governing behaviour allows us to think more about the different categories of interventions that can be used to influence decision-making. Five key classes of interventions are derived from systematic reviews of the available evidence : *information*, *incentives*, *restriction, enablement* and *cues*, (46). Each differentially engages the behavioural control systems (regulatory processes).

Many interventions aim to change the way people think by providing *information* (in the form of education or advice) that is supposed to persuade or train them to adopt a specific behaviour. As has already been discussed, economists and psychologists have also convincingly demonstrated that people respond to *incentives*, even if not always in the ways they would be predicted to. *Information* and *incentives* tend to activate reflective evaluation of the available courses of action (e.g., people rationally respond to changes in prices and costs). Interventions using *restriction*

usually create rules that reduce the opportunity to engage in harmful behaviours or in behaviours competing with the target behaviour (e.g, increasing the barriers). A recent example would be public smoking bans or banning drugs and other illicit substances. *Enablement* aims to increase the individual (psychological and physical) 'capability' and the external (physical or social) 'opportunity' to engage in the activity concerned (e.g., providing means and/or reducing barriers) (46). An example would include the creation of dedicated cycle lanes to encourage people out of their cars or hand gel dispensers in hospitals to facilitate people washing their hands. These four intervention types tend to focus on reflective thinking although there can certainly be contribution from System 1 processes in explaining their effectiveness or lack of. The final category *cues* are predominately linked to 'nudge' and Mindspace' effects' and are distinctly based on automatic regulatory processes, which are activated (often unconsciously) by stimuli in the immediate environment. Cues are the primary focus of the remainder of this thesis.

Discussion

Although dual process frameworks provide a simplified account of human behaviour, decision making can be explained by both System 1 and System 2 processing. Until recently the dominant theories of understanding behaviour focused on (System 2) deliberative processing such as behavioural intentions and risk perceptions (47, 48). As a consequence, policy makers and practitioners have focussed largely on trying to 'change minds' when thinking about behaviour change interventions. But the evidence on the effectiveness of interventions targeting cognitive processes is mixed and current initiatives certainly do not, it seems, guarantee behaviour change.

While behaviour change interventions targeting the reflective mind are undoubtfully important and should not to be ignored, awareness of the limitations of these approaches has resulted in alternative models incorporating the important distinctions between the two processing systems. Dual process models of behaviour drawing on psychological and neurobiological accounts of information

processes have been proposed that could enhance behaviour change interventions by recognising the power of automatic processing (49).

An improved understanding of System 1 processes and the contextual factors that govern a substantial part of our behaviour leads us towards new and refined policy tools (50). We can use this fresh perspective when designing the choice environment to make it easier for individuals to maximise their health and well-being. This should not necessarily be at the expense of ignoring System 2, and there is a real potential in considering how to best integrate the automatic and reflective processes that guide our behaviour.

The remainder of this thesis sets out how we may be able to start realising the beneficial impact of incorporating automatic processing and other behavioural insights into health and wider public policy. In the next chapter, I explore automatic processing further by defining the different Mindspace elements that represent a categorisation of the existing evidence on the different effects acting largely but not exclusively on System 1.

Chapter 2

2. Mindspace: A summary categorisation of automatic drivers of behaviour change

Summary

Government policy more often than not seeks to change the behaviour of large numbers of people. Policy makers have many levers to use to achieve behaviour change including regulatory approaches (e.g. public smoking ban), financial incentives or disincentives (e.g. a congestion charge to reduce the number of people driving into city centres) and information based campaigns (e.g. a letter based campaign to improve recycling). Underpinning many of these policy tools is the widespread assumption that people will respond to them in rational ways. A key implication from research across the behavioural sciences - and explored in Chapter 1 - is that traditional policies that assume rationality and therefore emphasise the importance of information and incentive based interventions, may be less effective than previously thought.

Interest has recently been shown in policies that 'nudge' people in particular directions; drawing on major advances in our understanding that behaviour is strongly influenced (in largely automatic ways) by the context and situation within which it is placed. One major weakness of the literature around behavioural economics and its application in policy design is that there are dozens of identified effects and a lack of an 'operational definition of nudging' (21). In this chapter I consider the theoretical basis for why nudges might work and present the 'Mindspace' framework that I co-developed whose aim was to facilitate policy makers and practitioners looking to implement 'nudge' type interventions.

The Mindspace framework was developed using a mixed methods approach incorporating an extensive literature review alongside expert interviews. Mindspace sets out what the authors considered to the most robust effects on behaviour operating largely, though not exclusively on

automatic neurobiological and psychological systems. The framework has gone on to be widely used in both the public and private sector and was used in my intervention studies described in later chapters.

This Chapter explores each of the different elements of Mindspace - messenger, incentives, norms, defaults, salience, priming, affect, commitment and ego. Evidence supporting each of the effects is provided from across a broad range of policy contexts. Chapter 3 provides more specific evidence for for the effectiveness of the different Mindspace elements in a health setting.

Introduction

The aim of much of public policy is to bring about changes in people's behaviour. Success will depend on the ability of policy makers to implement effective interventions, whilst avoiding harmful side effects. Any measure that intends to change behaviour, habits or practices either at the individual or population level can be classified as a behaviour change intervention. A systematic review by Michie et al of 19 classifications of behaviour change interventions identified nine broad categories of interventions and seven types of policy. These range from education and training based interventions to legislation and environmental restructuring (Figure 2.1) (46).

Recent behavioural insights provide policy makers and 'choice architects' with a set of new and enhanced policy tools to meet challenges in areas as diverse as preventative healthcare, crime and disorder and pensions and savings. As already discussed in Chapter 1, much public policy has sought to 'change minds' but the evidence seems to suggest that people do not always respond to this type of information in a rational way.

Despite the recent interest in behavioural economics and nudging, it is not a completely novel concept to think about the impact of the choice environment on decision making. There is evidence going back at least a century that researchers had recognised the powerful impact of context on influencing human behaviour (51). The recent appeal on the part of policy makers and practitioners is a likely consequence of a number of factors including the wide popularity of books like *Nudge* (4), *Predictably irrational* (10) and *Thinking, fast and slow* (18) and the attractiveness of potentially simple, low cost policy tools at a time of fiscal austerity (52). Not everyone shares the enthusiasm for 'nudging', with commentators citing amongst other factors, a lack of evidence to support a shift to their use (21, 53). Such perspectives are in part at least due to the lack of a robust or easily digestible framework in developing nudge-like interventions.

Figure 2.1: Categories of behaviour change interventions (from Michie (5))

Interventions	Definition	Examples
Education	Increasing knowledge or understanding	Providing information to promote healthy eating
Persuasion	Using communication to induce positive or negative feelings or stimulate action	Using imagery to motivate increases in physical activity
Incentivisation	Creating expectation of reward	Using vouchers to motivate smoking cessation
Coercion	Creating expectation of punishment or cost	Raising the financial cost to reduce excessive alcohol consumption
Training	Imparting skills	Advanced driver training to increase safe driving
Restriction	Using rules to reduce the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)	Prohibiting sales of solvents to people under 18 to reduce use for intoxication
Environmental restructuring	Changing the physical or social context	Providing on-screen prompts for GPs to ask about smoking behaviour
Modeling	Providing an example for people to aspire to or imitate	Using TV drama scenes involving safe-sex practices to increase condom use
Enablement	Increasing means/reducing barriers to increase capability beyond education and training	Behavioural support for smoking cessation, medication for cognitive deficits, surgery to reduce obesity, prostheses to promote physical activity

Policies		**Examples**
Communication/marketing	Using print, electronic, telephonic or broadcast media	Conducting mass media campaigns
Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Producing and disseminating treatment protocols
Fiscal	Using the tax system to reduce or increase the financial cost	Increasing duty or increasing anti-smuggling activities
Regulation	Establishing rules or principles of behaviour or practice	Establishing voluntary agreements on advertising
Legislation	Making or changing laws	Prohibiting sale or use
Environmental/social planning	Designing and/or controlling the physical or social environment	Traffic-calming' measures; use of prompts and reminders
Service provision	Delivering a service	Establishing support services in workplaces, communities etc.

Although *Nudge* become a bestselling book on both sides of the Atlantic, the behaviour change framework it put forward did not catch on with potential practitioners, with most discussions about the book focusing on the prominent examples of nudges instead. *Nudge* provided a set of 'basic principles for choice architecture' incorporated in a simple mnemonic nUDGES (Incentive, Understand mapping, Defaults, Give feedback, Expect errors, Structure complex choices) (see figure 2.2) but provided insufficient detail of how such insights could be used in designing policies and behaviour change interventions. A more substantive and comprehensive framework was sought and many government departments and other institutions in the UK produced reports and guides to facilitate intervention design in this area (54, 55).

In 2009, Sir Gus O'Donnell, then the Cabinet Secretary (the Head of the Civil Service in the UK) commissioned a review of the implications of behavioural theory for policy making with the aim of

building the capability to use behaviour theory in more effective ways. The result was the Mindspace report, which was published March 2010 by the Cabinet Office and Institute for Government. *Mindspace: Influencing behaviour through public policy* was produced with the aim of providing policy makers with robust evidence and support in designing and implementing behaviour change programmes utilising insights from behavioural economics. With colleagues (Paul Dolan at the LSE, Ivo Vlaev at Imperial and David Halpern and Michael Hallsworth at the Institute for Government), I contributed to the development of Mindspace as a behaviour change framework. Mindspace was developed through a mixed methods approach incorporating an extensive literature review of the psychological and neurobiological literature and interviews (n=42) (undertaken by Michael Hallsworth) with senior policy makers and behavioural scientists. Ideas were refined through expert panels that included the authors and academic and policy experts.

Figure 2.2: Behaviour change framework proposed from Nudge

Framework	Behaviour change technique	Definition
Nudge	Incentives	Humans respond to incentives rationally, as well as in a heuristic way (such as strongly avoiding losses)
	Understand mapping	Transform information about possible outcomes associated with available choice options into units that translate more easily
	Defaults	Options that are assumed as preselected if the individual does not make an active choice of another available alternative
	Give feedback	Provide salient warning signs in a way that supply information when people are doing well and when they are making errors
	Expect error	Assume error is inevitable and make the required action a habit by using recurrent cues and prompts
	Structure complex choices	Redesign the environment when people make choices among complex (multi-attribute) alternatives, so that the environment is manageable by mental habits

Mindspace: an overview

Mindspace seeks to gather up the most robust effects that operate largely, though not exclusively, on automatic or System 1 processes. As such it does not seek to cover all of the possible effects on behaviour, and does not deal with more traditional interventions that rely on providing information and education. Of the five intervention categories discusses in Chapter 1 (namely *information, incentives, restriction, enablement* and *cues)*, Mindspace effects (and other nudge type interventions) are primarily *cues* based and the different Mindspace effects illustrate some of main 'tools' at the disposal of policy makers seeking to influence behaviours through automatic processing.

Mindspace captures influences acting on automatic processing in a mnemonic - messenger, incentives, norms, defaults, salience, priming, affect, commitments, ego. The different Mindspace elements are summarised in Figure 2.3 with further detail also provided on the brain system that explains the response (from the expanded model provided in Chapter 1). Each of the different Mindspace effects are underpinned by considerable research from the fields of social psychology and behavioural economics. There is also increasing evidence to support these effects from the field of neuroeconomics, which integrates methods from neuroscience, economics and psychology to study individual decision-making (56).

There is no clearly logical ordering to the Mindspace effects and there is considerable overlap between some of them. Whilst Mindspace is primarily used to explain and target automatic processing, some of the Mindspace elements do incorporate a more reflective component (e.g. incentives, commitments and ego). The Mindspace effects reflect an interpretation of the ways in which the automatic system affects our behaviour – and in a format that was designed to provide

policy makers and practitioners with a salient and accessible framework to inform research and policy design, and assist non-experts in better understanding complex behaviour change. Each of the Mindspace effects are now defined in turn, with evidence on their impact drawn from both laboratory and field settings.

Figure 2.3: The Mindspace effects

MINDSPACE cue	Behaviour	Main brain system
Messenger	we are heavily influenced by who communicates information to us	Impulsive
Incentives	our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses	Impulsive
Norms	we are strongly influenced by what others do	Impulsive Habit
Defaults	we 'go with the flow' of pre-set options	Impulsive
Salience	our attention is drawn to what is novel and seems relevant to us	Habit
Priming	our acts are often influenced by sub-conscious cues	Habit
Affect	our emotional associations can powerfully shape our actions	Impulsive
Commitments	we seek to be consistent with our public promises, and reciprocate acts	Impulsive Habit
Ego	we act in ways that make us feel better about ourselves	Impulsive

The Mindspace effects

Messenger

We are heavily influenced by who communicates information

Whether people listen and act on information depends in a large part on who is doing the talking. The weight given to information is consequent on the reactions we have to who communicates that information rather than just on the specific content itself (57). In terms of behaviour change, an influential, trusted messenger can matter as much or even more than the message with 'influentials' catalysing the diffusion of opinions, behaviours and products through social networks (58).

People receiving information are affected by the feelings they have for the source of the message: for example, we may irrationally discard advice given by someone we dislike even if they are telling us something useful or in our own self-interest (6). The strong feelings we have for the messenger may well override traditional cues of authority that are usually deemed to be so influential, so that someone who has developed a general dislike of government interventions may be less likely to listen to messages that they perceived to come from that source in the future (59).

People appear to be affected by a range of messenger characteristics. We are influenced by the perceived authority of the messenger (whether formal or informal) (6). For example, in most cases people are more likely to act on information if experts deliver it. One study showed that interventions delivered by research assistants and health educators were more effective in changing behaviour compared with interventions delivered by either trained facilitators or teachers – and health educators were usually more persuasive than research assistants (31). It has also been shown that demographic and behavioural similarities between the messenger and the recipient can improve the effectiveness of the intervention. Importantly in relation to addressing inequalities, those from

lower socioeconomic groups appear to be more sensitive to the characteristics of the messenger, and this highlights the need to use messengers from diverse demographic and behavioural backgrounds (60).

We also, of course, use more rational and cognitive means to assess how convincing a messenger is. For example, we will consider such issues as whether there is a consensus across society (do lots of different people say the same thing?) and the consistency across occasions (does the communicator say the same thing in different situations?) (61). As with other effects, combining the lessons from context with those from cognition will lead to the most effective behaviour change interventions. In particular, we should think more carefully about which messengers to mobilise in which circumstances and whether they should focus mainly on the automatic or reflective ways of processing information.

Incentives

Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses

Incentives are central to economics and are used across the public and private sectors to motivate behaviour change. Economists often emphasize that 'incentives matter' and that higher incentives will lead to more effort and higher performance. While this may be broadly true, the basic laws of economics predict that the success of incentive schemes will also depend on a range of factors such as the type and timing of the incentive on offer (62) alongside behavioural insights that also demonstrate that people respond to a range of more subtle features (28). These insights can be used to help explain responses to incentives and could allow us to design more effective schemes.

The importance of incentive design is demonstrated in previous work by Fryer investigating how how financial incentives can be used to improve educational achievement (63). In a series of school

based randomised trials, incentives were only found to be effective when they were given for inputs to the educational production function. Incentives tied to educational outputs were not effective. Qualitative data suggested that because students did not understand the education production function, they were not able to 'turn their excitement about rewards' into meaningful achievement. The same may be true for people offered incentives to change health behaviours (i.e. schemes to encourage weight loss or smoking cessation).

Incentives that take account to people's cognitive biases (loss aversion, present bias) may be more likely to be effective than direct cash rewards. I now describe some of the predictable mental shortcuts that can influence responses to incentives and which can be categorised under the following themes: loss aversion, overweighting of small probabilities, hyperbolic discounting, increasing rather than decreasing payoffs and mental accounting.

Loss aversion

There is good evidence to demonstrate that people react more to losses than to gains of equivalent magnitude (9). Most incentive schemes offer rewards to participants but framing incentives as a charge that will be imposed if people fail to do something may be more motivating. While previous attempts to use financial incentives for teachers to improve student achievement had been unsuccessful, a scheme exploiting the power of loss aversion increased teaching quality by more than one standard deviation. In this scheme teachers were paid in advance and were asked to give the money back if their students performance did not improve. A second arm of the trial where the incentive was implemented in the standard fashion yielded smaller and statistically insignificant results (64). In the setting of a Chinese high-tech manufacturing facility, it was shown that bonuses posed as losses led to a greater response than when comparable bonuses were posed as gains (65).

Overweighting of small probabilities

People are seen to place more weight on small probabilities than standard economic theory would suggest (7, 9). This helps to explain the widespread popularity of lotteries and insurance. Whilst the tendency to overweight the probability of unlikely but salient outcomes can lead to problem gambling (66), it can also be used to positive effect using lottery based public policy interventions to motivate beneficial behaviours. Evidence suggests that lottery based incentives may be more effective than their expected value and be a useful strategy to boost motivation compared to using direct, guaranteed payments (67). The popularity of state lotteries in low income populations could suggest that lottery-linked incentives may be particularly motivating in low income populations (68).

A major challenge of corporate wellness initiatives (and preventative health programmes in general) is the low rates of participation. A behavioural economic approach to incentive design (using a lottery) was found to be significantly more effective that a direct economic payment of equivalent monetary value in getting a group of company employees to complete health risk assessments (69).

Hyperbolic Discounting

Economists generally assume that our preferences over today versus tomorrow are the same as those over this time next week and this time in eight days time. Whilst standard discounting in economics simply says that we use the same discount rate in each period, evidence tells us that today looms much larger so that we discount very heavily from the present and less heavily once we think about any time into the future. So given the option, many people would choose to take £18 today rather than £20 tomorrow but would be much less inclined to take the £18 in a weeks time than £20 a day later. This is known as ‘hyperbolic discounting’ and it leads people to discount the future very heavily when sacrifices are required in the present (70-72). Hyperbolic discounting has been demonstrated to be important in incentive design in relation to interest rate offers for credit cards where adverse selections were seen in a large randomized controlled trial in pre-approved

credit card solicitations. Consumers were at least three times more likely to respond to changes in the introductory interest rate as compared to equivalent changes in the post-introductory interest rate (73).

Increasing rather than decreasing payoffs

For complex behaviours, multiple incentives may need to be offered at intervals but how should they be given? It has been seen that people respond more to increasing payoffs, as opposed to decreasing or constant ones (74). This principle has successfully been used to develop interventions to treat problems with substance abuse (75). Such interventions usually include earning points contingent on individuals submitting drug or substance-negative urine specimens. Points usually begin at a low value and increase with each consecutive negative test result. A drug-positive result or failure to provide a scheduled specimen resets the voucher value back to the initial low value from which it could escalate again (75). Contingency management programmes could be used to improve outcomes across a wide range of different behaviours and populations.

Mental accounting

People often think of money as sitting in different 'mental budgets' for example savings or shopping. Spending is constrained by the amount sitting in different accounts as we are reluctant to move money between such accounts (76). This means that policies may encourage people to save or spend money by explicitly 'labeling' accounts for them, without removing their control over exactly how the money is used. Mental accounting means that identical incentives vary in their impact according to the context: people are willing to take a trip to save £5 off a £15 radio, but not to save £5 off a refrigerator costing £210 (77). The impact of a financial incentive could be boosted by linking it to one mental account rather than another

Other issues

Behavioural economics also provides some arguments against a reliance on incentives to influence behaviour. In our desire to change behaviour, we must consider that badly designed policies can exacerbate the challenges we currently face. For example, putting an explicit price on a behaviour may cause unexpected and perverse outcomes. Introducing a monetary fine for late-coming parents picking their children up from day-care centres significantly increased parents arriving late as the social contract in place was likely broken by a financial one (78). Monetary compensation can also lead to feelings that an activity is worthy in itself ('intrinsic' motivations) being 'crowded out' or partially destroyed (79). Once an activity is associated with an external reward, we may be less inclined to participate in the activity (or other beneficial activities) in the future without further rewards. An implication of this may be that if we provide an incentive for people to stop smoking, they may be unlikely to give up other damaging activities (e.g. alcohol misuse) without similar rewards. A meta-analysis of experimental studies found that extrinsic rewards could undermine motivation (80).

Norms

We tend to do what those around us are already doing

Social and cultural norms are the behavioural expectations, or rules, within a society or group and are seen as informal understandings of what is and is not appropriate behaviour. Norms can be explicitly stated ('No Littering' signs in public places) or implicit in observed behaviour (shaking the hand of someone you meet for the first time) and can guide behaviour in 'direct and meaningful ways' (81-83). People often take their understanding of social norms from the behaviour of others, which means that they can develop and spread rapidly. Once established, norms become part of a group's operational structure and can be difficult to change.

Two broad types of social norms have been described. *Descriptive norms* are peoples perceptions of what is commonly done in specific circumstances and detail what actually happens. *Injunctive norms* transmits group approval for a particular behaviour and details what should happen (81). Clearly there will be some overlap between descriptive and injunctive norms, not least that it would be strange for the perceived descriptive norm to favour a norm that the goes against the perceived injunctive norm. But studies undertaken comparing descriptive and injunctive norms suggests that their is some benefit in thinking separately about them (84).

Social norms can have a powerful automatic effect on behaviour and can influence actions in both positive and negative ways. Their power can come from the social penalties for non-compliance, or the social benefit that comes from conforming. Behavioural interventions using normative messages have been as an alternative to more traditional information based approaches as a primary behaviour change intervention in areas including gambling, littering, recycling and alcohol consumption (81, 85).

Social norms based approaches are usually based on telling people what other people do in a similar situation and are based on the finding that many people overestimate the prevalence of certain behaviours such as speeding or peer use of alcohol or recreational drugs (86). Consequently, social norms campaigns are largely premised on correcting misconceptions about the prevalence of different behaviours (descriptive norm) (87). In the ‘Most of Us Wear Seatbelts Campaign’, a social norms approach was used to increase the number of people using seatbelts. Initial data collection showed that individuals underestimated the extent to which their fellow citizens used seatbelts either as drivers or passengers. Although 85% of respondents to a survey claimed to always wear a seatbelt, their perception was only 60% of other citizens adults did. An intensive social norms media campaign was launched to inform residents of the true proportion of people who used

seatbelts. As a result of the campaign the self-reported use of seatbelt significantly increased (See Fig 2.4) (88).

Figure 2.4: Advert from the 'Most of us wear seatbelts' campaign



There are a number of insights that can be taken from studies utilising social norms approaches. The first is that the impact of any intervention may be enhanced if the norm is related as much as possible to the target audience. In recycling, when a hotel room contained a sign that asked people to recycle their towels to save the environment, 35.1% did so. When the sign used social norms and said that most guests at the hotel recycled their towels at least once during their stay, 44.1% complied. And when the sign said that most previous occupants of the room had reused towels at some point during their stay, 49.3% of guests also recycled (83).

Secondly, norms may need reinforcing and if the norm is not immediately apparent to people, repeated efforts may be required for its effects to become self-sustaining. In energy conservation, a large-scale programme (over 80,000 homes) sent letters that provided social comparisons between a household's energy use and that of its neighbours (as well as simple energy consumption information. The scheme was seen to reduce energy consumption by 2% relative to the baseline.

Interestingly, the effects of the intervention decayed over the months between letters and increased again upon receipt of the next letter (89).

Finally, normative messages can risk increasing the frequency of undesirable behaviours. Sometimes campaigns can increase perceptions of undesirable behaviour. When households were given information about average energy usage, those who consuming more than the average reduced their consumption – but those who were consuming less than the average increased their consumption. This 'boomerang' effect was eliminated if a happy or sad face was added to the bill, thus conveying social approval or disapproval.(90)

Defaults

We 'go with the flow' of pre-set options

Many of the decisions we take have a default option. Defaults are the options that are pre-selected if an individual does not make an active choice. Defaults exert influence as individuals regularly accept whatever the default setting is, even if it implies very different consequences. The preference for things to stay the same has been termed the status quo bias with individuals seen to disproportionately and predictably stick with the pre-set option (91).

The rational model of decision making suggests that 'preference-relevant' features of different options are irrelevant such that the order in which choices are presented should not affect the individual's decision-making. But across different contexts, decision-makers are very often seen to display a strong affinity for the status quo alternative. Preferring the default option could be consistent with rational decision making if the choice sets are the same or when transition costs are high but often the decision to stick with the status quo is costly and seemingly irrational (91). Studies of the default setting in pension savings, insurance choice and internet security settings all show large and substantial effects of sticking with the default (12, 33, 92). For example with

automatic enrolment into a pensions savings plan, almost no employees are seen to opt-out of the scheme. But when employees need to actively opt in to the scheme then less than half are seen to do so during their first year of employment (12).

Many public policy choices have a no-action default imposed when an individual fails to make a decision (4, 34). This default setting has often been selected through natural ordering or convenience, rather than a desire to maximise benefits for citizens. Structuring the default option based on a desire to maximise benefits for citizens can influence behaviour without restricting individual choice.

Salience

Our attention is drawn to what is novel and seems relevant to us

Providing information is a prominent part of the policy-makers toolkit. Behaviour is greatly influenced by what what our attention is drawn to (7). As we go about our daily activities, we are bombarded by different stimuli which would otherwise overwhelm our limited cognitive abilities and so we unconsciously filter out much of the information presented to us as a coping strategy. Behaviour change studies have demonstrated that information is taken into account only if it is salient. For example, when attentional or cognitive resources are restricted, individuals can focus only on the most salient behavioural cues, which leads to actions that are under the motivational influence of those cues (93).

So people are more likely to register stimuli that are novel (for example a message in flashing lights), accessible (items on sale next to checkouts) and simple (a snappy slogan). Our attention is also much more likely to be drawn to things that we can understand and we are much more likely to be able to encode things are presented in ways that relate more directly to our own personal experiences than to things presented in a more general and abstract way (94). In a widely cited US

experiment, researchers chose 750 products subject to a sales tax that is normally only applied at the till, and put additional labels next to the product price, showing the full amount including the tax. Putting the tax on the label, rather than adding it at the till, led to an 8% fall in sales over the three-week experiment. In addition, it has been shown that, over a 30-year period, taxes that are included in posted prices reduce alcohol consumption significantly more than taxes added at the register (95). Salience may therefore offer a way of complementing traditional price levers in policy-making.

Anchoring is an important cognitive bias to appreciate in relation to developing salience based interventions. Anchoring is the tendency to rely too heavily on the first piece of information offered in making subsequent decisions. This is well demonstrated through an experiment undertaken by Tversky and Kahneman. Participants in a study were asked to rapidly compute (or estimate) one of the following two calculations.

a. 1 x 2 x 3 x 4 x 5 x 6 x 7 x 8

b. 8 x 7 x 6 x 5 x 4 x 3 x 2 x 1

Because of the time limit set, participants had to estimate the final product after the first few multiplications. When starting from the lower numbers, the median estimate was 512. When starting with the larger numbers the estimate was 2,250 (the actual answer is 40,320). Where people lack specific knowledge about a topic (for example, buying a bottle of wine at a restaurant), experiments show that we look for an initial ‘anchor’ (i.e. price of the cheapest bottle of wine or the house) on which to base our decisions. It has been shown that the minimum payment amount on credit card statements attracts our attention and informs our decisions. When a credit card statement had a 2% minimum payment on it, people repaid £99 of a £435 bill on average; when there was no minimum payment, the average repayment was £175. In other words, presenting a minimum payment dragged repayments down (95). Insights such as this may offer more sophisticated means

of regulation. Anchors can exert their influence over time and long after conditions change (96). This is related to the well-known 'confirmation bias': people tend to pay little attention to information that challenges an existing belief or hypothesis, and focus intently on any supportive information (97).

Priming

Our acts are often influenced by sub-conscious cues

Priming explains that people's subsequent behaviour may be altered if they are first exposed to certain sights, words or sensations and is one mechanism to influence behaviour outside of conscious behaviour. In other words, people behave differently if they have been 'primed' by certain cues beforehand.

Priming responses have been demonstrated across a range of stimuli (including words, visuals and smells). Simply exposing people to words relating to the elderly (e.g. 'wrinkles') led to study participants subsequently walking more slowly when leaving the room.. In other words, they had been 'primed' with and elderly stereotype and behaved accordingly (98). Similarly, asking participants to make a sentence out of scrambled words such as fit, lean, active, athletic made them significantly more likely to use the stairs, instead of lifts (99). Priming participants in a study with religious vs. non-religious words found that those exposed to the religious prime acted more pro-socially as a result, being more likely to help a charity at the end of the experiment (100). It is not just words that can prime subsequent behaviours. Cues of being watched are seen to lead to observable changes in behaviour including in encouraging a reduction in littering. Displaying images of eyes for example has been shown in both laboratory and real world settings to cause people to act more pro-socially (101, 102). Meanwhile, mere exposure to the scent of an all-purpose cleaner made more people keep their table cleaner while eating in a canteen (103).

Priming effects appear real and robust although there have been recent concerns raised about the difficulty in replicating some of the early, seminal studies in priming such as Bargh's finding that walking speed can be influenced by unconscious primes associated with the stereotype of old age. The debate associated with these controversies seems to be encouraging more research in the field of rather than less (104). Certainly more work is required to understand which of the thousands of primes that we encounter every day may be having significant unconscious effect. Priming is therefore perhaps the least understood of the Mindspace effects, but has significant implications for policy. For example, it is likely that the environments that government constructs or influences are constantly 'priming' people to act in certain, perhaps undesirable, ways. Government should seek the ways it may be unintentionally priming people – or it may seek to 'build in' priming effects to its current attempts to change behaviour.

The discovery of priming effects has led to considerable controversy, not least to the slightly sinister idea that advertisers – or even governments - might be able to manipulate us into buying or do things that we didn't really want to buy or do. Some of these issues are explored further in Chapter 10.

Affect

Emotional associations can powerfully shape our actions

Rational utility theory tends to disregard emotion as a key force in decision-making, even though affective reactions are often the first responses people have to stimuli and can strongly guide information processing and judgment (105, 106). There are two broad perspectives on the role of affect (the act of experiencing emotion) in decision making. The first relates to the role of emotional associations or evaluations in response to different cues and the second to decision-making whilst in hot versus cold states.

Affect plays a powerful role in decision-making. Emotional responses to words, images and events can be rapid and automatic, so that people can experience a behavioural reaction before they realise what they are reacting to. Fear or disgust are obvious examples of emotions that can take control of our actions. We have immediate responses to people we first meet (attraction or repulsions) and non verbal cues are often demonstrable before a verbal response, providing a true lens into someone's opinion or evaluation about a topic (106).

That emotions play such a primary role in decision-making may seem obvious to anyone who has bought a house based on a visceral feeling walking through the door rather than any careful weighing up of the location and floorspace but the role of affect in decision-making has tended to be seen quite differently. Conventional thinking in psychology and economics saw affect as being 'post-cognitive' - that is a mood is generated only after considerable processing of information and any subsequent evaluation. Prevalent models suggestion that 'objects must be cognitized before they can be evaluated' has been countered by views that affective reactions are primary (106, 107).

Emotional responses, rather than deliberate decisions, can therefore influence judgments, meaning they end up contrary to logic or self-interest. Many social marketing campaigns have used the power of emotion by emphasising relevant attributes that elicit an affective response. In one experiment, direct mail advertisements for loan offers varied in the deal offered, but also in elements of the advert itself. It was found that the actual advertising content had a significant effect on take up of loans, rather than just prices. In particular, including a picture of an attractive, smiling female increased demand for the financial product by the same amount as a 25% decrease in the loan's interest rate (108).

Certainly underlying mood can also have a powerful role in decision-making with people in good moods tending to make unrealistically optimistic judgements, whilst those in bad moods make unrealistically pessimistic judgements. Behavioural economists refer to visceral states that may

interfere with decision-making as ‘hot states’ with examples including sexual arousal, hunger or fear. When people are not tired or hungry they tend to underestimate the impact of being in such states on decision-making (109). Similarly when we are excited or fearful, it is difficult for us to think rationally about the consequences of our behaviour, outcomes that are clear to all in cold emotional states.

Commitment

We seek to be consistent with our public promises, and reciprocate acts

Many important everyday decisions involve inter-temporal tradeoffs between immediate and delayed gratification. People tend to procrastinate and delay taking decisions that are likely to be in their long-term interests (110). Being all too aware of their will-power weaknesses (such as a tendency to overspend, overeat or continue smoking) people frequently use commitment devices to control procrastination and achieve long-term goals. Commitment devices have been categorised as soft or hard depending on the consequences that result from failure. Everyday behaviours that are can be construed as commitment devices include cutting up credit cards, only taking a fixed amount of money when heading out for a night and not keeping alcohol in the house (111).

Although the decision to ‘pre-commit’ may be a reflective or ‘system 2’ rational action, the subsequent effects of commitment devices operate largely through automatic or ‘system 1’ processes. Thus, commitment devices offer an example of reflective judgments made in advance to produce an ‘automatic’ response in favour of the person making the decision. It has been shown that commitments usually become more effective as the costs for failure increase. One common method for increasing such costs is to make commitments public, since breaking the commitment will lead to significant reputational damage. Even the very act of writing a commitment can increase the

likelihood of it being fulfilled, and commitment contacts have already been used in some public policy areas (6).

Commitment devices can be used by people to impose penalties for failing to act according to their long-term goals (112). Students, for example, are willing to self-impose costly deadlines to help them overcome procrastination (113). It has been shown that people who know they tend to 'live for today' desire commitment devices. One major randomised controlled study designed a commitment savings product for a bank in the Philippines, which was intended for individuals who want to commit in the present to restrict access to their savings. Average savings balances were seen to increase by 81 percentage points for clients assigned to the treatment group relative to the control group (114). In the *save more for tomorrow plan* experiment, pre-commitments to increasing savings contributions with pay rises led to the average savings rate for the participants increasing from 3.5% to 11.6% (115)

A final aspect of commitment is the importance of reciprocity. People have a very strong instinct for reciprocity, which is linked to a desire for fairness that can lead us to act irrationally. We can see the desire for reciprocity strongly in the attitude of 'I'll commit to it if you do'. Reciprocity effects can mean that, for example, accepting a gift acts as a powerful commitment to return the favour at some point, which is why free samples are often effective marketing tools (6).

Ego

We act in ways that make us feel better about ourselves

People have a psychological need to maintain the impression of a positive and consistent self-image. This need is manifested in the way we interpret events and experiences and may lead to subconscious changes in attitudes and/or behaviours.

When things go well in our lives, we attribute it to ourselves. But when they go badly, we see fault in other people, or the situation we were put in – an effect known as the 'fundamental attribution error' (116, 117). We think the same way for groups that we identify with. Psychologists have found this group identification to be a very robust effect, and its power is so great that – like a number of the other effects above – it changes how we see the world (118). The classic illustration of this effect is the retrospective recall of sports fans of their team's performance in a match. Fans systematically misremember, and misinterpret, the behaviour of their own team compared with the opponents. A match in which both teams appear equally culpable of committing fouls to an impartial observer will be seen by a partial fan as one characterised by far more fouls by the opposing team than their own (119).

Advertisers are well aware that we view the world through a set of attributions that tend to make us feel better about ourselves (120). Male respondents donate more to charity when approached by more attractive female solicitors for door-to-door fund-raising, which suggests that giving is also the result of a desire to maintain a positive self-image (in the eyes of the opposite sex in this case) (121).

We also like to think of ourselves as self-consistent. So what happens when our behaviour and our self-beliefs are in conflict? Interestingly, often it is our beliefs that get adjusted, rather than our behaviour (122). The desire for consistency is used in the foot-in-the-door technique in marketing, which asks people to comply with a small request (e.g. filling in a short questionnaire for free), which then leads to them complying with larger and more costly requests (e.g., buying a related product) (123). Once they have made the initial small change to their behaviour, the powerful desire to act consistently takes over – the initial action changes their self-image and gives them reasons for agreeing to subsequent requests ('I did that, so I must have a preference for these products'). In other words, small and easy changes to behaviour can lead to subsequent changes in behaviour that

may go largely unnoticed (124). This approach challenges the common belief that we should first seek to change attitudes in order to change behaviour.

Similarly, it has been shown that the greater the expectation placed on people, the better they perform (125). Thus, people with positive expectations internalise their 'positive' label and succeed accordingly; but this influence can also be detrimental if a negative label is used (126). A self-fulfilling prophecy is created, whereby people behave in a way that is consistent with the expectation of others.

Our desire for positive self-image leads to an (often automatic) tendency to compare ourselves against others and 'self-evaluate' (127). When we make these comparisons, we are biased to believe that we perform better than the average person in various ways: 93% of American college students rated themselves as being 'above average' in driving ability (128). This bias may require policy makers to go beyond what might be considered optimal in regulating some behaviours. For example, it might be necessary to enforce stricter working hour limits for professions that impose risk on others, such as long distance drivers and medical staff, because people will overrate their ability to cope with fatigue and stress; or set very low levels of acceptable alcohol consumption when driving, because drivers will overestimate their driving skills.

Discussion

Dozens of strategies and frameworks have been established to support policymakers, academics and practitioners design and implement behaviour change interventions. It is clear that no one framework is uniformly successful in designing behaviour change interventions and there is a real need for research that can compare the effectiveness of different tools.

Many books, reports and academic papers have highlighted the potential benefits of approaches based on insights from behavioural economics that until recently has been an under-researched

area . The Mindspace framework provides an accessible overview of some of the most robust and powerful effects operating (largely) on automatic processing that can be used as tools for behaviour change (in addition to interventions that are designed to change behaviour by changing minds through the reflective system). These principles are underpinned by considerable laboratory and field research from social psychology, cognitive psychology and behavioural economics (17, 129).

The Mindspace elements - messenger, incentives, norms, defaults, salience, priming, affect, commitment, ego - do overlap with the intervention categories put forward in the book Nudge: incentives, understand mapping, defaults, give feedback, expect error, and structure complex choices. But in which primarily aimed to provide a overview of the field of behavioural economics for the general reader, Mindspace aims to provide a more structured framework for policy makers looking to design, implement and evaluate behaviour change interventions. This may explain the popularity of Mindspace amongst policy makers and practitioners and its use as the original operating framework for the *Behavioural Insights Team* which was established by Prime Minister David Cameron (130, 131).

This chapter provides evidence for each of the Mindspace elements from across public policy More in-depth case studies that were written for the Mindspace report can be found in Appendix 1. In the next chapter I look at more specific evidence for the Mindspace effects from the health domain.

Chapter 3

3. Mindspace in healthcare

Summary

Contrary to traditional theories of rationality, people frequently fail to make choices that benefit their health and wellbeing. In some cases people make suboptimal health related choices but do so actively and consciously and maybe for good reason. But very often people's decision-making is out of keeping from their underlying intentions leading to significant consequences. People continue to smoke, drink alcohol and eat to excess despite overwhelming evidence of harm and a personal desire to live more healthily. Most health professionals claim to follow evidence-based guidelines but there is overwhelming evidence of substantial gaps between evidence and actual practice exist.

The insight that decisions made by policy makers, patients, health service users and healthcare workers are guided not just by reflective processing but also by automatic processes has important implications for understanding health-related behaviours as well as designing interventions. This chapter discusses each of the different Mindspace elements introduced in Chapter 2 but is focused at their potential role and impact in the health domain.

Evidence supporting the impact of Mindspace effects in healthcare was collected through electronic databases, which were searched non-exhaustively for eligible studies reporting at least one outcome related to a change in designated behaviour and a range of common health behaviours/choices including, smoking, alcohol and obesity. A more detailed description of the search strategy within the Chapter.

Introduction

The result of suboptimal decision-making in healthcare is considerable. Nearly half of all premature deaths in the developed world are attributable to health related choices particularly around exercise, smoking and diet (1). Millions of people continue to smoke in the United Kingdom despite widespread knowledge about its detrimental effects (132), patients often fail to take the medications that have been prescribed for them (133), and in the specialist surgical clinic I work in, more than 1 in 5 patients fail to attend their appointment (134, 135).

The hazardous effects of behavioural risk factors have been widely established in prospective cohort studies and randomised trials and much of the extra morbidity, mortality and costs we see could be reduced by health service users making better choices (136). Weight loss can reduce the incidence of diabetes and other diseases (137) whilst fifteen years after stopping smoking, the risk of cardiovascular disease is similar to that of those who have never smoked (138). By following recommendations on the best management of chronic diseases, people can significantly reduce the impact of diseases with behavioural components. Good control of diabetes reduces eye related disease by half and kidney damage by two thirds (139), whilst lipid lowering therapy reduces death from coronary artery disease by a fifth (140).

It is not just patients and the public whose decision making is less than perfect. Many of the decisions that health professionals take are hard to explain on a rational basis including sometimes doing too much off the wrong thing (repeated testing, extensive tests for unlikely diagnoses) or too little of the right thing (screening for common conditions or prescription of the right medications) (141). Patient safety data alone demonstrates the impact of suboptimal decision-making with approximately 10% of patients suffering some form of harm during an inpatient stay in NHS hospitals (142). The causes of doctors poor decision-making and irrationality are not peculiar to the medical domain but are the result of the irrational reasoning which people are susceptible in general

(143). It is not surprising given the complexities of modern diagnostics and management and the volume of information and data that health professionals need to use these 'mental shortcuts' that can facilitate error. In an analysis of all patients admitted over a 24 hour period in a UK hospital, there were a total of 44 diagnoses. If reading the relevant guidelines related to all these conditions (e.g. NICE protocols), the on-call doctor would have needed to read over 3500 pages of information (which was estimated to take approximately 122 hours) (27, 144, 145).

Policy makers and practitioners increasingly recognise the importance of the behavioural dimensions of many of important challenges of health policy and the potential for substantial gains gains to be made by relatively small changes in the choices people make (146). There are a number of examples of effective behaviour change interventions that have had some measure of success such as anti-smoking initiatives and campaigns to encourage people to wear seat belts and discourage drink driving (5, 54). But there are many examples of unsuccessful interventions and we are still faced with a short supply of effective interventions that can be translated into best practice (147). The problem is that many existing theories and interventions have not been very effective at changing the behaviour of either the providers or the consumers of healthcare. The dominant theories of health behaviour (and wider decision making in healthcare) such as Ajzen's theory of planned behaviour are premised on similar assumptions to rational utility theory and focus on reflective precursors of action and that changes in behaviour will come about through changing a person's conscious cognitions (47, 48).

Traditionally, behaviour change policies and interventions in healthcare have tended to focus on providing new *information*, which seek to change the way people think about their behaviour or different (financial or legal) *incentives* that change the consequences of behaviour (148). But these interventions have got us only so far. Take smoking for example. Whilst rises in the tax on tobacco has been seen to reduce overall levels of smoking (149), they may also serve to increase the

proportion of smokers using potentially more harmful smuggled tobacco (approximately 21% of tobacco used in the United Kingdom is now smuggled) (150). Moreover, whilst further information campaigns may facilitate quit attempts, they could further widen the noticeable disparities in the prevalence of smoking between the higher and lower educated members of our communities (151).

Information and incentive based interventions targeting individuals or groups rely on influencing the way people consciously think about their behaviour. This may involve anything from a social marketing campaign encouraging people to attend for vaccinations to sustained and intensive one on one behaviour change programmes. The problem as discussed in Chapter 1 is that a substantial proportion of the variance in behaviour is not explained by intentions (14, 15). The dominance of automatic processes in guiding the behaviours underlying many of the policy challenges we face may help explain why interventions targeting the rational mind so often fail (18).

As an example of the limitations of intention-based interventions in healthcare, consider an attempt to increase physical activity by changing behavioural determinants and teaching behaviour change strategies in an at-risk group in the community that was reported in the Lancet. The programme involved a one-year individualised programme delivered by trained facilitators in participants homes or by telephone. Although there was some difference in intention to exercise six months into the programme, this did not translate into objective differences in behaviour as compared to a comparison group. The intensive intervention was no more effective in increasing physical activity than a basic advice leaflet promoting physical activity sent to a comparison group who had also attended an initial screening assessment (and neither intervention actually had much effect on behaviour at all) (152).

In contrast to economic models of rational choice suggesting that we respond to information and price signals, it appears that choices in healthcare (like in other fields) can often come about as a result of contextual or environmental influences. The enhanced understanding we now have of

decision-making processes provides us with opportunities of influencing choices in healthcare by changing the 'choice architecture' through Mindspace interventions.

Clearly a good knowledge base is important in making optimal decisions either about one's own health or in the case of health professionals, that of others. Without discounting the need for continuing information based interventions and better education, targeting problems in automatic processing has been relatively ignored. Looking at 100 cases of diagnostic errors (through autopsy discrepancies and quality assurance activities), a study by Graber found 548 different system-related or cognitive factors. Knowledge based slips on 11 occasions and problems in data gathering on 45 occasions. There were 265 instances identified of failing 'synthesis' (defined as problems with the processing and verification of information) (153). Common causes of problems included a failure to continue considering reasonable diagnostic alternatives, faulty context generation, misjudging the salience of findings and errors from the use of heuristics.

I focus herein on the evidence that supports Mindspace elements in healthcare. At the time of the literature search, the research teams and policy makers undertaking intervention studies will have been unaware of Mindspace and in many cases the field of behavioural economics. Whilst not necessarily realising their research was targeting automatic processing, the interventions included encompass the Mindspace elements explored in Chapter 2.

Search strategy

The initial search was purposely broad. A computerised, non-exhaustive search of the following electronic databases was undertaken: MEDLINE (PubMed), Cochrane Controlled Trials Register, EMBASE, PsycInfo and Google Scholar. We obtained additional articles from reference lists of pertinent articles No date limits were applied and the final date that papers were collected from was the 1st of July 2011. There was a preference for RCT's and clinical trials but also considered

laboratory and observational studies. Studies taking place in developing countries were included but the search was limited to articles published in English. All relevant full-text review articles, guidelines and non-reviewed notable studies were sought though the search was non-exhaustive given the substantial volume of research papers in the area of health related behaviour change.

Eligible studies were included if they reported at least one outcome related to a change in designated behaviour or outcome – functional status, health outcome, utilisation of healthcare resources or cost data - after the intervention. Search terms included, but were not limited to 'behaviour change' and either 'behaviour change', 'intervention', 'policy' AND particular behaviours targeted including but not limited to 'smoking', 'alcohol', 'obesity', 'exercise' 'Diet, high fat', 'street drugs', 'heroin', 'marijuana', 'cannabis', 'cocaine', 'contraception', 'condom' 'sexually transmitted diseases', 'medication adherence', 'vaccination' and 'transplantation'.

A single reviewer examined the search results to identify potentially relevant reports describing interventions potentially targeting automatic processing. Full texts of relevant reports were assessed for inclusion by two reviewers working collaboratively. Any disagreements were resolved by discussion and if necessary by involving a further member of the research team. Relevant articles were further categorised into one of the nine Mindspace categories.

Evidence of Mindspace interventions in healthcare

Messenger

Effective communication is an integral part of health promotion strategies such as encouraging participation with vaccination programmes or improving medication adherence. But it is not just the content of the health information (e.g. please take your medications at the time they are prescribed) that is important. Our reaction to the source of the information/message will also determine its impact with responses to messages influenced by both the perceived authority of the messenger and

also the feelings for the source of the message (6, 15).

For doctors and nurses at least it is reassuring that the public continue to trust health professionals more than other professions (154). This has important implications when we consider the number of health messages that the public are provided with and also the range of people providing health advice. Certainly health messages appear to be more likely to create an impact if using a credible source for the population being targeted (155). A meta-analysis of 166 HIV-prevention interventions found expert interventionists produced greater behaviour change than non-experts and the demographic and behavioural similarity between the interventionist and recipients facilitated behaviour change (57).

In addition to being influenced by the perceived expertise of the person giving the health message, we are also influenced by the familiarity of the messenger. So whilst expertise clearly matters, so do peer effects. Demographic and behavioural similarities between the messenger and recipient can increase the power of the messages being delivered. This may be particularly true in disempowered populations who appear more sensitive to the information giver (57). We know there are significant problems with patients adhering to medication and treatment regimes (156). This is often the result of patients not understanding why they need to take the treatment prescribed and also how it should be taken to be most effective. ‘Patient educators’ who are patients with the condition (e.g. diabetes, asthma) can be used to demonstrate effective management techniques. The ‘Health Buddy’ scheme involved older students receiving healthy living lessons from their schoolteachers. The older students then acted as peer teachers to deliver that lesson to younger ‘buddies’. Compared with control students, both older and younger ‘buddies’ enrolled in this scheme showed an increase in healthy living knowledge and behaviour and beneficial effects on weight (157).

The use of peer-based programmes as behavioural strategies in chronic diseases has been well explored including in diabetes (158). In breast feeding It is known that most mothers stop before the

recommended 6 months post-partum. Previous systematic reviews showed that breast feeding support delivered by health professionals did not substantially improve breast feeding outcomes beyond 2 months post-partum. A randomised controlled trial evaluating the effect of peer (mother to mother) support demonstrated significant improvements in breast feeding compared to a control group (providing conventional care) (159). The National NHS programme, the Health Trainer Programme, aimed at changing health behaviours in hard to reach groups succeeded in engaging target groups (deprived and ethnic minority groups) by often using 'trainers' from those communities. Significant changes in self reported behaviours of physical activity, health eating, smoking and BMI were seen with the programme (160).

Incentives

It is well established that a higher price reduces consumption (161). In smoking, we see that cigarette consumption in Europe is seen to decrease by about 5% for every 10% increase in the real price of cigarettes and that increasing the price of alcohol is among the most effective options for reducing consumption (50, 149). Incentive programmes in healthcare can take forms besides 'sin taxes' for example by subsidising healthy behaviours or rewarding adherence to a treatment programme (162).

Increasing interest has recently been shown in using financial incentives to promote desirable health behaviours (e.g. exercise, health eating) and discourage unhealthy ones given the finding that health behaviours can be significantly affected by the structure of economic incentives that individuals face (163-165). Incentives have also been implemented to target provider behaviour as a means to improve quality of care. For example, in 2004 in the UK, a significant proportion of general practitioners' pay became tied to a quality and outcomes framework (166).

Incentives can take a number of forms including cash or alternatively vouchers that can then be exchanged for desirable items. One recent example is the 'Give it Up For Baby' programme in Tayside, Scotland that used grocery vouchers to encourage pregnant smokers from socially deprived communities to quit smoking (167). Health England has recommended the more widespread use of incentives (165), although their use does attract substantial controversy. Some commentators have charged that they are coercive and inequitable (168). Concerns tend to centre on the potentially coercive impact of using incentives and the 'unfairness' of rewarding people for doing things that are already in their own interest (e.g. quitting smoking) (163). A particular worry is the effect of using incentives on intrinsic motivation building on Richard Titmuss' classic work on blood donations. Titmuss argued that monetary compensation for donating blood might crowd out the supply of blood donors and through a series of field experiments demonstrated that the supply of blood could decrease by up to half when payments were introduced (169). There is a risk that incentives in one area (e.g. smoking) may undermine a persons motivation to make the right choice in other areas without similar reward (170). Despite these concerns, a *Citizens Counsel* convened by the *U.K National Institute for Health and Clinical Excellence (NICE)*, found that a majority of representative members of the British public supported the use of incentive schemes to influence health behaviours (171).

Overall, incentives do appear to work in the health domain (172), with a structured review showing effectiveness for defined outcomes in the majority of randomised controlled trials in which they have been implemented (162). Incentives have generally been seen to be more effective for one off behaviours like vaccinations (162), with their effectiveness and long-term sustainability when targeted at the more challenging and complex behaviours such as smoking and obesity not so well demonstrated (62, 173). There is also limited evidence suggesting that appropriately targeted incentives could reduce inequalities in health outcomes (174, 175).

The success of incentive schemes targeting health behaviour will depend not only on the type of behaviour being targeted but also on a range of factors well recognised from standard economic texts. These will include the magnitude and the timing of the incentive, and the income levels of those targeted (161). Generally the higher the incentive and the more immediate its delivery - the bigger the impact that can be expected (176, 177). Loewenstein argues that the many programmes being implemented by health care providers and insurers that use incentives to encourage patients to take better care of themselves are unlikely to have much impact because they still require 'information, expertise and self control' that few patients possess. Loewenstein suggests how deploying insights from behavioural economics to support incentive design has the potential to deliver dividends for patients and health systems (178), by 'supercharging' incentive schemes to 'motivate behaviour change more effectively than simple premium adjustments do' (179, 180). For example, we can utilise the finding that people strongly prefer avoiding losses more than they like gains of the same amount – a tendency known as loss aversion - in designing incentive schemes. (9) A randomised trial of incentives for encouraging weight loss found they could be effective – at least in the short term – when people risked losing money (180). This is in contrast to a systematic review that found little effect on weight loss by offering standard financial incentives (62). The suggestion from this study is that the fear of losing money may have created a stronger incentive to lose weight than simply providing a straight financial reward.

There are other insights from behavioural economics – hyperbolic discounting, increasing payoffs, and commitment devices – that could also lead to real improvements in the design of incentives targeting health behaviours. Lottery based financial incentive programmes play on the finding that people overweigh small probabilities when large rewards are on offer. Such schemes have been seen to be effective in both weight loss interventions and in improving anticoagulation (warfarin) control (67, 180). And for complex behaviours, where multiple incentives may need to be offered at

intervals, it has been seen that people respond more to increasing payoffs, as opposed to decreasing or constant ones (74). This principle has successfully been used to develop interventions to treat drug addiction and substance misuse and to improve medication compliance (75).

More work in looking at incentive design is certainly required and some of the work of the Centre for the Study of Incentives in Health (co-directed by Professor Paul Dolan) has been directed at investigating how behavioural insights could enhance the effectiveness of personal financial incentives in healthcare. In late 2013, the NIHR agreed to fund a proposal from myself, Ivo Vlaev and other colleagues investigating different incentive schemes to encourage diabetic eye screening. Commenced in mid 2014 and recruiting its first patients, we have implemented a randomised controlled trial to investigate what impact loss aversion and lottery based incentives can have on enhancing screening participation.

Norms

Because of people's innate impulses to belong and seek affiliation with groups and similar others, the influence of what others around us are doing can be a powerful driver of our own behaviour (45). Social norms also help to explain contagious and harmful behaviour through large interconnected social networks e.g. people are more likely to be obese or smoke if others around them share these characteristics or behaviours (181, 182). Within small social groups problem behaviours can develop for example the rate of eating disorders is much higher in certain female sport teams and sorority groups (183).

Using norms as cues for behaviour change is reported in several papers by Robert Cialdini and is usually based on telling people what others are doing in a similar situation (184-186). College students are frequently seen to overestimate their peers drinking behaviour (descriptive norm) and to misinterpret the approval amongst their peers for harmful levels of alcohol use (or binge

drinking) (injunctive norms) (86). Social norms theory predicts that is these misperceptions are corrected, then people will drink less. A Cochrane review evaluating social normative interventions in reducing alcohol misuse in university and college students found them to be effective when delivered through web/computer feedback and individual face-to-face feedback. Feedback delivered by mail or through groups were not on the whole significant (187). Conformity with local social norms in relation to other preventative health behaviours has been seen to be a powerful driver of decision making in areas including hand hygiene, healthy food choice, exercise and alcohol misuse (44, 184, 188, 189).

Manipulating norms could have a positive influence not just on patients and the public but also on the choices of health professionals. Health systems want to encourage health professionals to practice evidenced-based medicine and follow established guidelines but often this is not seen to be the case. A study conducted to evaluate compliance with American College of Chest Physicians Consensus advice on anti-thrombotic therapy guidelines, found that the overall compliance rate was just 13.3% in over 120,000 patients whose care was evaluated (190). Making health professionals more aware of what is the considered professional 'norm' may have a influence subsequent behaviour. The publication of mortality data from cardiothoracic surgeons in the United Kingdom has led to an improvement in subsequent outcomes and this may in part be due to a 'industry norm' being set (191).

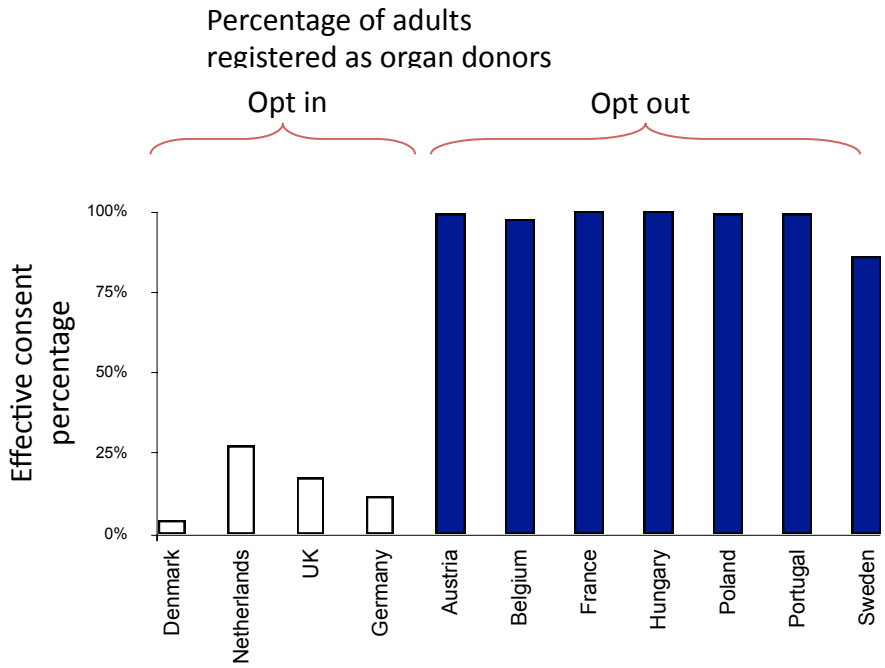
As discussed in Chapter 2 in the social norms section, it is important to recognise that providing *norms* information can have negative effects on positive health-related behaviour change. As an example, providing information about low participation in cancer screening actually demotivated the intention of members of the public to take up screening opportunities compared to control groups (192).

Defaults

Patients and health professionals often face a pre-selected option if they do not take an active decision. In an editorial in the New England Journal of Medicine, Halpern suggested that default options may affect a far broader range of health care decisions than most people generally realise and could be better used to improve healthcare outcomes (35).

All too frequently, little thought is given to what the default settings should be. As people often lack established preferences regarding their choices in healthcare, default settings could be used to improve outcomes rather than make them worse (35). The most powerful example of the use of defaults in public policy to date is the impact of automatic pension enrolment where an opt-out default has been seen to significantly improve participation (12). In healthcare, powerful effects of defaults on behaviour have also been observed in relation to employees' contributions to healthcare flexible-spending accounts and organ donation decisions (34, 193). In the case of organ donation, most countries have one of two default options, either people have to actively opt-in to being on the donor register or they need to opt-out of being automatically enrolled. Through three different studies, Johnson and Goldstein demonstrated that effective consent rates to join the organ donor register could be increased by changing the default from an opt-in policy to an opt-out (34). The difference in default setting can be well demonstrated by looking at effective consent rates in countries with and without opt-out schemes (see figure 3.1). It is seen that the percentage of adults on the donor register was over 75% whilst in Denmark it was much less than 5%. The main difference is that Sweden has an opt out policy, whilst Denmark has an opt-in.

Figure 3.1: Comparison of organ donation registration in opt-in and opt-out health systems (34)



In an intensive care setting, dramatic improvements in clinical outcomes have been seen when default lung-protective settings and breaks in sedation for ventilated patients were ordered unless otherwise indicated by a physician (194, 195). The trial was stopped early because the mortality rate was 25% lower with the new default setting. Such interventions demonstrate that targeting the providers of healthcare, in addition to patients and the public, may be an effective strategy in achieving improved healthcare outcomes. Default settings targeting the provider side could be used to reduce unnecessary investigations and treatments ordered by health professionals. Patients are often subjected to a range of investigations after clinicians tick 'all in one' orders and risk being harmed by procedures that are not always necessary. Changing the default have been seen to significantly influence providers' laboratory test ordering practices with the potential of decreasing unnecessary expenditure (196, 197).

Salience

With limited perceptual and cognitive resources, people's choices tend to be affected by anything that falls within the focus of their limited attention span (198). There are a number of examples of where the users and providers of healthcare are given a bewildering amount of information and are expected to decide on a utility maximising option but fail to do so. In choosing their Medicare Part D (prescription benefit in the USA), consumers are expected to choose from one of dozens of possible plans. But on an analysis of the policies taken up, less than 10% of those enrolling picked the most cost effective option for them (199). Providing the information in a more easily understood format could have encouraged consumers towards a better decision.

With the inherent complexity of many health delated decisions, very often choices can be made on the basis of a single most salient or important criterion, with individuals ignoring other relevant information (200, 201). This principle was applied in a field intervention testing whether information on HIV risk can change sexual behaviour among teenagers in Kenya (202). Providing information about a single criterion – the relative risk of HIV infection by partner's age group – led to a 28% decrease in teen pregnancy and 61% decrease in the incidence of pregnancies with older, riskier partners. In contrast, there was no significant decrease in teen pregnancy after the introduction of the very costly national HIV education curriculum, which provided general information about the risk of HIV and did not focus the message on the risk distribution in the population.

In another example, participants in a smoking cessation programme were given their results in terms of a novel and salient 'lung age' rather than a raw forced figure of lung volume. By providing the information in this format, verified quit rates at 12 months were significantly higher in the intervention group (13.6% vs 6.4%, p=0.005, NNT = 14). The authors of this paper were unsure of the mechanism through which this impact took place but the salient nature of the feedback seems to

be the most explicable reason (203).

Priming

In Chapter 2, I provided the example of how exposing people to words such as *fit*, *lean*, *active* and *athletic* and objects such as walking shoes and running magazines, could 'prime' people to be more active (e.g. taking the lift instead of the stairs) (99). Priming may be the least understood and explored element of Mindspace, but there is evidence largely from experimental studies that support the practical potential of 'primes' in encouraging healthier choices.

It has been demonstrated that children exposed to food advertisements increase their total food intake (204). It has also been seen that the amounts of food people serve and consume can vary depending on the size of food containers used. Participants in an experimental study served themselves 53% more calories and consumed 56% more calories than those taking food from a smaller bowl (205). Moviegoers ate 45% more popcorn when it was given to them in a 240g container than a 120g container; even when the popcorn was stale, the larger container made them 33.6% more popcorn (206). Sounds can also prime attitudes or moods and thereby influence behaviour. In retail settings, music is often used to stimulate purchasing behaviour and certain types of music were seen to significantly increased the amount of time and money spent by patrons in bars (207).

More emphasis could be directed at creating an environment that encourages or 'primes' pro-health behaviours and discourages unhealthy activities. For example, the design of the built environment may influence whether you take the escalators or stairs. Strategies such as reducing plate and container sizes in schools have the potential to bring about significant shifts in behaviour at relatively low cost.

Affect

Affect is a powerful automatic force in decision-making in healthcare, where emotional rather than deliberative responses are often seen. We know that people make rash or ill-judged health related choices because of their emotional state at the time. Illness usually involves emotions such as fear, emotional uncertainty and anxiety and this may influence subsequent important decisions that are taken. The emotional aspects of patient-provider communication represents a crucial challenge to healthcare providers (208). It may be useful for clinicians to be provided with strategies to ensure that medical decisions (which should be a collaborative effort between patient and doctor) are not overtly affected by short term emotions. For example a 'cooling off' period may be beneficial before a final decision is made about a treatment plan. Currently, clinicians often advise a course of treatment for the patient in the same consultation as a diagnosis is provided. It may be more prudent to wait a few hours before decisions are made in an emotionally fragile state. This is well demonstrated through a study which found that in a 'cold state' less than 10% of respondents would choose to endure chemotherapy that extends their life by only a few months. But when actual cancer patients were asked (then in a hot state), nearly half said they would be happy to trade of the discomfort of chemotherapy for a few weeks of extra life (209).

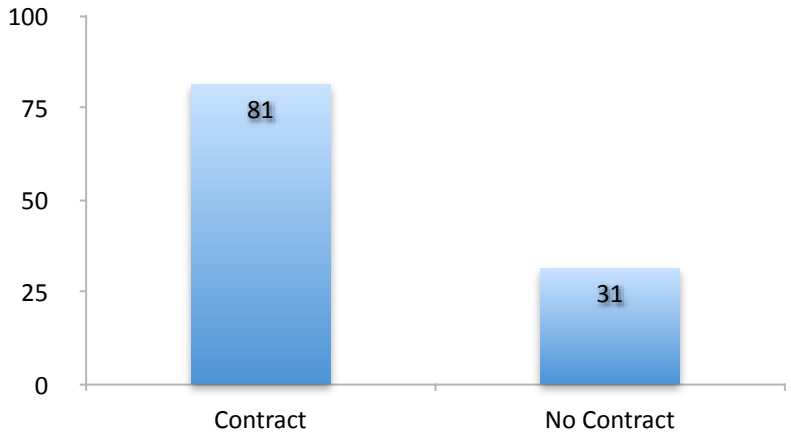
Provoking emotion is used as a strategy to influence health related behaviour change. Attempts to promote soap use in Ghana were originally based around the benefits of soap – but only 3% of mothers were found to wash their hands effectively with soap after toilet use. Researchers noted that Ghanaians used soap when they felt that their hands were dirty (e.g., after cooking or traveling), that hand-washing was provoked by feelings of disgust. As a result, the intervention campaign focused on provoking disgust rather than promoting soap use. Soapy hand washing was shown only for 4 seconds in one 55-second television commercial, but there was a clear message that toilet use prompts worries of contamination and disgust, and requires soap. This led to a 13% increase in the use of soap after the toilet and 41% increase in reported soap use before eating (210).

Many successful social marketing campaigns targeting unhealthy behaviours (e.g. smoking, obesity) have done so by generating a strong visceral or emotional reaction in the public. A successful example of this is the graphic warnings provided on cigarette packets that cause increased reactions amongst smokers that are prospectively predictive of cessation activity (211, 212). Further determining the impact of different emotions (e.g. anger, disgust, sympathy) on behaviour needs to be better defined through well designed studies.

Commitment

People make commitments as they are all too aware of their impulsive weaknesses and tendency to procrastinate. People wishing to stop smoking or exercise have long used commitment devices to support their intentions and there is limited evidence of their effectiveness (213). To increase physical exercise, a firm commitment to achieving a goal (such as 10,000 steps a day using a pedometer) significantly increased the success of achieving that aim. An experimental study compared two groups; one group signed a contract specifying the exercise goals to be achieved whilst a control group were simply given a walking programme but did not enter any agreement or sign a contract. All participants recorded daily walking activity for 6 weeks and the contract group were significantly more likely to achieve their exercise goals (see Figure 3.2) (214).

Figure 3.2: Percentage of individuals in a contract group meeting walking goals



Commitment contracts may be made more effective if there is more than simply a reputational loss at stake. A commitment contract (known as CARES) for smoking cessation asked people to make a voluntary commitment to stop smoking. In addition they pledged their own money that they would pass a urine test for nicotine metabolites six months later. If it was negative they would have the money returned to them (without interest), but if they failed the money was donated to charity. Those signing up to the CARES contract were significantly more likely to pass the 6-month test as well as a surprise test at 12 months than a control group, indicating that such a scheme could produce lasting smoking cessation (215).

There could a wider use for commitment devices in healthcare. Citizens have a responsibility to use NHS resources properly. This includes attending clinic appointments and taking medications as prescribed. We know that there is often a poor compliance with health professionals recommendations, which can have a serious impact on outcomes. Commitment contracts are a verbal or written agreement that a patient makes with themselves or with health professionals, where participants commit to a set of behaviours. Limited evidence has shown that such contracts can helpfully contribute to adherence (213).

Ego

People behave in ways that support the impression of a positive and consistent self-image and enhance social status (44, 102, 216). Attempts to reduce smoking and other unhealthy behaviours should consider if the habits are bound up with a desire for self-esteem and positive self-image, which means self-esteem may be an effective route for change (pointing out that smoking causes yellow teeth and impotence) (217).

A number of studies have demonstrated that unfavourable social images of the type of person who

engages in specific risk behaviour (e.g., the "typical" smoker or drinker) are associated with less willingness to engage in such behaviours, including unprotected sex (218), drinking (219), driving under the influence (219) and smoking (e.g., smokers with negative images of smokers are more likely to be successful at quitting) (220). Also, individuals exposed to a manipulation with favourable characteristics of images of people who exercise (e.g., appearance, general health, energy level, attitude toward life, achievements, social relationships) increased their exercise behaviour (221).

Discussion

Health-related choices are central to many of the challenges that are faced in health policy. In some cases what appear to be poor decisions (to miss a clinic appointment or not take a medication as prescribed) may be taken consciously and after full consideration of the risks and benefits. Whilst recognising that interpretations of utility of different decisions will vary between individuals (222), there is usually a strong wish on the part of most people to make choices that maximise health and well-being.

Recent insights from acrossthe behavioural sciences provides us with a powerful set of new and refined policy tools to use when trying to influence behaviours in health (25, 223). To date the use of such principles have been hindered by the lack of a coherent and useable framework and Mindspace represents an attempt to provide a useful 'checklist' for policy makers and practitioners. Each of the Mindspace elements have evidence supporting their use in the health domain as demonstrated by the evidence presented in this Chapter. By recognising the potential role of automatic processes and Mindspace cues, practitioners and policy makers will be able to better exploit System 1 processes.

Mindspace does not provide the answers to all the problems we face. The use of conventional

policy tools such as legislation and price changes should be supported when and where they work. In the case of alcohol use, for example, evidence suggests that increasing the price of drinks may be a powerful motivator of reducing alcohol consumption (224), and we should certainly not ignore this and other conventional tools where effective. The use of price rises here is a classic economic use of incentives but other interventions are also likely to be required to transform behaviours around alcohol use. Norms and salience could all be used to help to make existing laws around not serving alcohol inappropriately work better – at the moment, there is little incentive to enforce the law, no norm behaviour and the law is surely far from being salient to many bar staff serving alcohol. In addition, defaults of smaller measures of alcohol could be used or social marketing campaigns informing people of the true consumption levels of relevant others.

There is still much we do not know about the Mindspace elements in healthcare. There remains uncertainty over how long the effects last and how well they work in different segments of the population. We do not have a comprehensive understanding of the potential impact of such policies on inequalities – although some limited evidence suggests that interventions targeted at the automatic system may be less likely to be dependent on education and income and therefore a more equitable way of influencing behaviour. Anti-smoking advertisements that contained highly emotional elements were found to have greater impact on people with low and mid- socioeconomic status than among high-socioeconomic status groups (225). When introducing behavioural interventions we should also remain vigilant of compensating behaviours and spill-over effects that can result from behavioural interventions. The finding that most people put weight on following successful attempts to quit smoking or that high levels of exercise may result in compensatory mechanisms – such as overeating – suggest the need for joined up thinking, and clarity about the over-arching objectives of policy (38, 226).

A better awareness of the role of automatic decision-making in healthcare could accomplish a

number of things. Broadly these can be divided into two core elements. Firstly, strategies to increase conscious awareness of heuristics and cognitive biases. With a greater knowledge of these effects, patients and service users and the providers of healthcare can better anticipate and avoid problems. A number of 'debiasing' strategies have been put forward to support enhanced decision making (153, 227, 228). And secondly, the use of a group of interventions that could counter these biases or alternatively go with the grain of human behaviour so that the same errors that trip people up could also be used to help people make better choices (229).

These questions will only be answered by supporting intervention studies and rigorously evaluating them. There is an increasing number of field studies investigating nudge type policies to draw evidence from – although much of it currently exists outside of the health domain (17). Before turning to describe the studies that I have undertaken to support the evidence for Mindspace effects in healthcare, I look first at how Mindspace can be used to think about the theoretical basis of understanding and intervening in a specific area of health policy.

Chapter 4:

4. Lowering health spending growth using insights from behavioural economics

Summary

The aim of this chapter is to demonstrate how Mindspace can be used to focus on one specific area of health policy and examine its role developing specific interventions. This article examines the challenge facing most developed health systems (and particularly the United States) where spending on healthcare is taking up an ever greater part of GDP. This Chapter demonstrates the potential use of Mindspace as a checklist for policymakers and practitioners to use. This Chapter is also used to explore many of the cognitive biases and heuristics underpinning behavioural economics and its interventions.

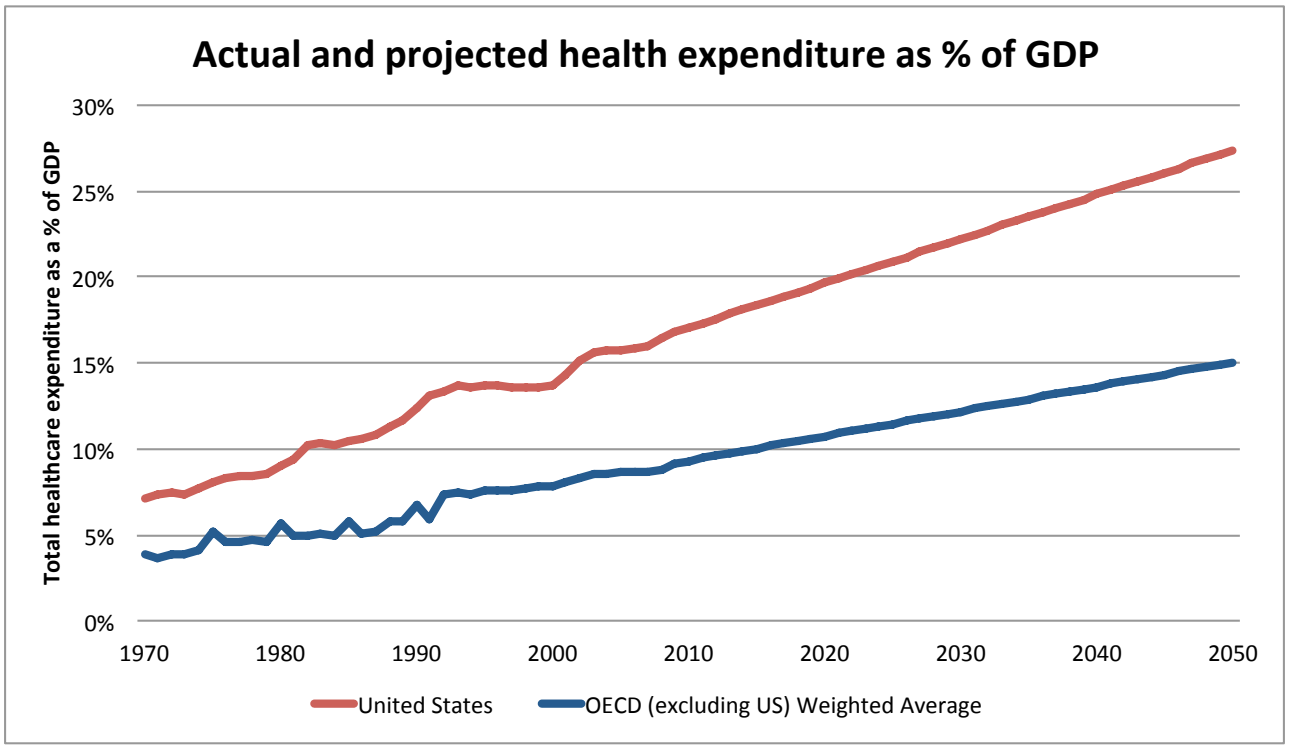
Bending the 'cost curve' in healthcare spending continues to pose a challenge to policy makers worldwide. Traditional methods of expenditure control (for example, rationing, price-capping and the introduction of competition) appear to have had limited success. This may be in part because these traditional policies are based on how people should behave when they are rational, not on how they actually behave. In policy arenas such as pensions and personal savings, approaches based on behavioural economics have provided notable results. In healthcare, such approaches have been used successfully but in limited ways, and they have the potential of providing low cost, high impact solutions. With health care spending climbing at unsustainable rates, this chapter reviews the role that approaches based on behavioural economics could play in offering policy makers a potential set of new tools to slow spending growth.

My interest in this particular topic came from leading a report for the *World Economic Forum* in this area. I subsequently led a more focused piece looking at these implications for the US health system that was subsequently published in *Health Affairs*.

Introduction

Health care spending in most advanced economies is on an unsustainable course. Consider the OECD economies. Figure 4.1 demonstrates how expenditure on health as a percentage of GDP is set to grow over the next 40 years. Not only does increased spending force painful trade-offs with other priorities such as education, infrastructure or welfare, for some countries, the explosion in health expenditure will threaten their future fiscal health. Despite a historic slowdown in the rate of economic growth in recent years, spending on health care in the United States grew faster than the economy as a whole in 2013, a trend echoed in most other developed economies (230). Bending the 'cost curve' - the trend line in health care cost growth- remains an elusive goal for governments around the world, with rising spending seen as a force that is very difficult to reverse (231).

Figure 4.1: Expenditure as a percentage of GDP in OECD countries



There is a real problem in funding this increased expenditure, particularly in a period of prolonged austerity, that many countries currently find themselves in. There is a strong desire to reduce cost growth while avoiding difficult decisions like the rationing of beneficial care, increasing individual patient contributions (e.g. greater user charging or out-of-pocket payments) and imposing cuts that could have unintended consequences. An example of the latter would be reduced physician reimbursements in Medicare that made some physicians less willing to serve Medicare beneficiaries, as appears to have happened to some degree in the United States. But reducing costs without drastic measures is likely to be achievable only if ways are found to influence the decision making of the key actors in health systems with greater success than in the past. Those key actors are providers, patients, policy makers, and industry executives, all of whose actions can drive up spending on healthcare.

Increasing expenditure on health systems can be broadly put down to two underlying trends, increasing demand for healthcare and the rising costs of healthcare. Demand growth is a consequence of demographic shifts and the demand for more and better healthcare as people have tended to get richer. We are also spending more on each patient or episode of care through the use of new and expensive drugs and other therapies (232).

A variety of policies have been designed to slow expenditure growth and can target either the consumers or providers of healthcare (see Fig 4.2). But the conventional tools that are available have failed to achieve the necessary outcomes required to bend the health spending curve. Efforts to contain health expenditure have not followed any single conceptual framework. However, the policy levers in use, which often rely on price changes and information-based interventions, are largely informed by rational choice theory, which assumes that people weigh the probabilities and utilities of possible outcomes based on information in the marketplace about price, quality, function, and other factors, and that they then reliably pursue the option that provides the most benefit. But

policies that rely on ‘rational’ responses often fail to achieve their objectives when it comes to meeting the challenge of spending on health.

For example, pay-for-performance schemes include financial incentives that should encourage providers to improve the quality of care they provide, lower the costs of that care, and sometimes do both. Yet there is little evidence that these programs have reliably led to improved care or greater cost-effectiveness (233). Similarly, patients continue to make suboptimal decisions despite being given ever more choice and information. In one study fewer than one in ten people given access to information and a choice of plans as part of Medicare’s Part D prescription drug program picked the most cost-effective option (199).

The insights challenging the traditional assumptions of rationality identified through work in behavioural economics can be applied to cutting spending on ineffective health care and this is the focus of the remainder of this article.

Targeting automatic processing

As discussed in previous Chapters, much of the time people will act quite automatically, without really thinking about their decisions. The human brain is able to process multiple inputs simultaneously and unconsciously, and it does so by using a number of simplifying heuristics. Using these shortcuts bypasses full information processing requirements, allowing people to make decisions more easily.

Figure 4.2: Conventional policy interventions to reduce health spending

Policy	Description
Rationing access	Eligibility criteria may be employed to restrict access to services or treatments. Single-payer systems (e.g. the NHS in the UK) may also delist or deny funding for treatments or therapies not deemed cost-effective. Government bodies such as NICE in the UK are charged with determining cost-effectiveness and making rationing decisions.
Gate-keeping	Demand for healthcare can be directly suppressed by instituting 'gate-keeping' mechanisms between patients and healthcare providers. In the NHS, primary care physicians and services are often charged with managing access to services and controlling costs by screening out unnecessary referrals to hospital.
User-charging and incentives	Many health systems employ different types of user-charging to suppressing demand. User-charging may take the form of a deductible or share of the cost of accessing services with the intention of discouraging unnecessary visits or treatments. Health Savings Accounts (e.g. Singapore) and Consumer Directed Health Plans (e.g. US) are interesting variants of user-charging. These allow citizens to recoup the 'savings' if they use less healthcare than they are budgeted, creating direct incentives to avoid unnecessary use.
Reimbursement structures	Most advanced economies reimburse their hospitals with payments that relate to the number of patients they see for groupings of particular conditions or procedures (known as Diagnosis Resource Groups in Germany or Healthcare Resource Groups in the UK). These payment structures are designed to encourage providers to treat patients in cost-effective ways: by paying providers a fixed sum, the intention is to induce them to find ways of treating patients for less than this sum and retain the savings.

Policy	Description
Competition	Encouraging new private sector entrants is a key policy tool designed to create incentives amongst payers and providers to achieve efficiencies and reduce costs in a way that simulates market mechanisms at play in other sectors.
Expenditure capping and price controls	To contain supply-side costs many countries have attempted to impose price controls. These controls may apply to the prices at which payers reimburse providers or suppliers, such as drug companies or even wages where collective agreements are in place.

For the most part these rules of thumb work well, but they can lead people into predictable errors that distort 'rational' decision-making processes. Familiar examples include taking price as an indicator of quality or assuming that bigger or more is better. In clinical contexts, these mental shortcuts may lead to excessive diagnostic testing and a preference for new and expensive diagnostics that are either not necessary or more expensive than alternatives that are equally effective.

Behavioural scientists have identified dozens of heuristics that can put people out of touch with their conscious desires and lead to imperfect and costly decisions. Heuristics and cognitive biases have been seen to be a robust source of influence in the judgment of decision options in health settings (234, 235). I now look at a number of these cognitive biases that may influence healthcare expenditure. A larger list of heuristics and biases are defined in Figure 4.3.

Status quo bias

People's decision-making is predictably affected by their tendency to prefer things to remain the same (91). This is important as most real world decisions have an option where doing nothing is a possibility. Status quo biases explain in part the finding that physicians routinely prescribing familiar medications when better or cheaper alternatives exist (236-238), and why consumers are

reluctant to transfer existing health plans to more cost-effective alternatives (91, 237). Several cognitive biases play into people sticking to the status quo, including loss aversion and endowment effects. Loss aversion is the tendency for people to strongly prefer avoiding loss to acquiring gains (7) and endowment effect describes the finding that people value things they hold more than equivalent things they do not have (26).

Implementing evidenced-based, guideline driven care leads to improved clinical and economic outcomes but physicians are often resistant to discontinuing treatments when evidence arises of its lack of efficacy (239). As a consequence patients often receive ineffective care with estimates that 30-40% of patient encounters do not follow established recommendations (240, 241). Of course, health professionals may fail to act according to the best available evidence for many reasons, however psychological factors may be particularly important given the strong pull individuals have to current and familiar behaviours. If a way could be found to normalise correct, cost effective procedures in medical care, we could harness this resistance to change as a force for cost control.

Affect bias

The affect heuristic is a mental shortcut that allows people to quickly make decisions where emotion plays a lead role and affective reactions are often the first responses people have to stimuli, strongly guiding subsequent information processing and judgment (105, 106). A reliance on a 'gut feeling' provides a quicker, and often more efficient way of navigating complex and uncertain choices. But like the other heuristics affectual responses can also deceive us into making irrational decisions. Advertisers are well aware of the powerful role of emotions in consumer choices, with tobacco companies using images of attractive smokers alongside positive straps to negate the cognitive impact of warning messages (242). Similar strategies that provoke emotion could be used to positively influence health behaviours, and may be more cost effective than simply delivering 'dry' information (243).

Physicians and policy makers are susceptible to emotions and the decisions they make may be taken to fulfil emotional impulses rather than to achieve outcomes as effectively or cost efficiently as possible. Where possible, important and cost sensitive decisions should not be taken in 'hot' emotional states (see Chapter 3), where people are seen to neglect long-term goals in favour of alleviating negative visceral states (244, 245).

Framing bias

Choices can often be presented as two descriptions of the same thing – the glass is either half-empty or half full. One of the most prominent examples of biases affecting decision making are framing effects. Framing effects describe the situation in which people behave differently depending on whether a choice is presented as a gain or a loss (30). Framing effects raise questions about how probabilistic information is presented as peoples responses to logically equivalent decisions (90% chance of surviving a surgical procedure versus a 10% risk of not surviving) are often contradictory and influenced by format (246). Generally, it has been shown that people tend to prefer avoiding risky alternatives when the outcome emphasises potential gains (e.g. surviving an operation), but are more willing to choose risky options when outcomes emphasise loss (e.g. dying) (30).

The consequence of these findings is that important decisions with cost implications may be taken on the basis of framing effects rather than an analysis of the facts. In a meta-analysis focusing on health behaviours rather than intentions, gain-framed messages - those highlighting the benefits of engaging in a particular preventative behaviour - were seen to be more effective than loss framed messages (247). The influence of framing effects on the decision making of physicians is less clear, although there is some interesting evidence that when reasoning on their own behalf, physicians are susceptible to framing but are less susceptible to the bias when making decisions on behalf of others (248, 249).

Framing effects also raise concerns that valuation decisions taken by policy makers may be inconsistent and unreliable. Tversky and Kahneman provide a widely cited example of the effect of variations in framing on the choice of different health programs to combat an infectious disease outbreak. When the outcome was phrased 'positively' in terms of lives saved, subjects preferred the risk-averse alternative, but when outcomes were phrased 'negatively' in terms of lives lost, the risk seeking option was preferred . Such decisions have obvious cost implications (30).

Availability bias

The availability heuristic occurs when people base decisions on whatever ideas and information comes most readily to mind. Availability exerts a strong influence when events are more immediate and, memorable and emotional (250). The availability heuristic is an unconscious process that simplifies the challenging task of judging probability, but can lead to systematic errors as what comes to mind is not usually an accurate reflection of actual facts (251). In a widely cited study from the 1970's, people asked the probability of a variety of causes of death thought that accidents caused about as many deaths as disease, but the reality at the time was that diseases actually caused about 16 times as many deaths as accident (252). Further follow up demonstrated that skewed probability judgments correlated strongly with skewed reporting frequencies in newspapers (253).

Health professionals are also susceptible to availability bias, with initial incorrect clinical suspicions leading clinicians to inappropriately ordering expensive and time-consuming tests (254). Clinicians have been seen to overestimate the probability a patient has a certain disease and/or order investigations as result of previous exposure or media coverage to certain conditions (255, 256). So an emergency physician who has recently seen a patient with a headache that proved to be a subarachnoid haemorrhage may be more inclined to think of a similar scenario the next time they sees a patient with a headache. This may be no bad thing, but given less than 1% of headaches

presenting to emergency rooms are subarachnoid haemorrhages, an availability bias may lead to unnecessary investigations that are costly and delay safe discharge from hospital (257).

For policy makers, decisions with cost implications will ideally be made on consideration of all the relevant evidence. But even where robust scientific data is available, interpretations of risks and benefits of policy decisions may be influenced by a narrow focus of attention and subject to salient influences from different media outlets and special interest groups (258). This can lead to resources being directed to certain therapeutic areas as a consequence of compelling stories in the press rather than on any rational application of evidence-based policy making and may account for the wide variations in expected costs of adding quality-adjusted life years (QALY) with different medical interventions (259). Sunstein suggested that governments often devote 'resources to little problems rather than big ones' and are prone to react to 'short term public outcries' (242). Funding decisions may often reflect these realities.

Confirmation bias

Confirmation bias refers to the tendency of people to selectively search for and interpret information or hypotheses that confirms existing pre-conceptions. People rarely enjoy being proved wrong. Rather than impartially evaluating evidence to arrive at an unbiased conclusion, individuals selectively gather information that gives undue weight to evidence supporting a hypothesis, whilst discounting evidence that reports against it. In some situations people deliberately build a biased case, but confirmation bias refers to an unconscious selectivity of information (36). Some critics have gone so far as to suggest that a significant proportion of published research findings may be false, often simply reflecting the 'prevailing bias' (259).

Confirmation bias is seen to have an impact on decision-making in many contexts, including in clinical settings (143). Physicians are often seen to categorise patients by diagnostic or treatment

strategies and confirmation bias may lead them towards overvaluing confirmatory support of their initial suspicion and undervaluing disconfirming evidence (260, 261). This may lead to physicians do not always revising diagnoses in the light of new findings, leading to unnecessary investigations and potentially expensive failures of diagnosis and treatment (262).

Policy makers are well used to building a case to support their views. In some cases the preferential inclusion of supporting evidence is intentional, but very often complex policy decisions may be influenced by unintentional confirmation biases (263). This also leads to a preference for evidence that supports policies where adoption and implementation have been committed too – possibly with expensive consequences.

Table 4.3: Other cognitive biases contributing to spending problem

Cognitive biases	Possible contribution to spending problem
Anchoring In the absence of objective probabilities, people rely heavily on past reference points (that may be arbitrary)	In price negotiations, costs for health services may be determined by past prices (anchor) leading to unnecessarily high prices being paid for services in the future
Commission bias The tendency to favour action over inaction, even when there is no objective support for doing so	Physician may fail to adopt an appropriate – and more cost effective - watchful waiting strategy (e.g. for benign prostatic hypertrophy)
Focusing effect The tendency to place too much importance on one aspect of an event	A treating physician might base diagnostic and treatment decisions on specific aspects of a patients presentation, leading to unnecessary investigations
Overconfidence bias A tendency to have excessive confidence in one's own intuitive reasoning and cognitive abilities	A policy maker may push through a policy despite lack of evidence of its cost-effectiveness
Planning fallacy The tendency to underestimate task-completion times	Policy makers may underestimate completion times and costs of new policies

Applying Mindspace to the healthcare spending crisis

Despite evidence demonstrating the importance of automatic processing in decision making, most traditional policy tools challenging excessive health spending have targeted the reflective mind. I now discuss how Mindspace can explain and/or counter the behavioral components that contribute to spending on ineffective health care. The examples come largely from the US health setting, which is a consequence of the health spending crisis facing the country and the level of interest in finding sustainable solutions. Clearly differences exist between health systems in the developed world with a heavier reliance on costly investigations and procedures. Whilst the examples provided may not be immediately transferrable to other systems, there has been a general trend worldwide for higher usage of costly technologies (3). I provide examples of policies or initiatives from the research literature where applicable.

Messenger

Automatic responses to the source of the message can influence reflective reactions to the message's content and source credibility is very important. If we are aiming to get physicians to incorporate best practices into routine care, it is important to know that physicians take more note of information and recommendations from professional organisations than of almost identical advice from health insurance organisations.

A study published in 1994 reported that 82 percent of physicians trusted clinical guidelines from their own professional association, while only 6 percent of physicians trusted the same recommendations from insurance companies (264). Similarly, the proportion of parents having confidence in vaccine information depended in large part on the source of the information. Seventy-six percent of parents endorsed the advice of their child's paediatrician; just 23 percent endorsed the advice of government experts or officials (265).

Incentives

Incentives are widely used in the health domain to influence the behaviour of both providers and patients. However, incentives by themselves are not always acted on in predicted ways, with a range of heuristics and cognitive biases shaping individuals' responses (explored more fully in the previous two chapters). Work by Volpp has shown how incentives inspired by insights from behavioural economics can be used to improve medication adherence, specifically in the case of warfarin, a drug whose suboptimal use places millions of users at risk of stroke and major bleeding each year, which can have large financial consequences for health systems (67).

Norms

Underlying a number of behaviours with cost consequences is the fact that people incorrectly perceive the attitudes and behaviours of others to be those of the majority. That is, perceptions of reality tend to be heavily influenced by anecdotes and personal experience. As a consequence of the desire to conform, this can be an automatic but powerful driver in motivating people to adjust their behaviour toward a pseudo-norm.

Once established, norms of behaviour can be hard to change even when they are harmful and counterproductive. Such norms have been well documented in the cases of smoking, illicit drug use, weight gain, and a variety of other health behaviours (266). Social norms are among the best predictors of alcohol misuse on college campuses, exceeding the relative contribution of demographic factors, drinking motives, and alcohol expectancies - that is, expectations of alcohol's physiological effects (189).

Interventions that seek to reduce harmful misperceptions of peer norms have been successfully used to reduce problem alcohol use. For example, a comprehensive set of interventions communicating accurate local norms of alcohol use in college students not only reduced misconceptions about

alcohol misuse but reduced by at least 30 percent the personal consumption of alcohol and the negative consequences associated with problem drinking (189). The UK government is implementing a large-scale trial of a similar initiative across all universities in Wales (267). Successful strategies are required to counter problem alcohol use which is estimated to cost the UK billions of pounds a year. The U.K government claims that alcohol related harm now cost society (England) £21 billion dollars a year (NHS costs of £3.5 billion a year (2009-10), alcohol related crime of $11 billion a year (2010-11) and lost productivity of £7.3 billion (2009-10) (268).

Defaults

Decision making is predictably affected by the tendency people have to prefer that things remain the same (91). This is important because most real-world decisions have doing nothing as an option. Policy makers' choice of default in systems involving human choice has large and often important effects, but very often the default setting is chosen without a specific goal in mind (35).

Using defaults as a policy tool in health care has come to prominence in relation to their influence on organ donation registration, following evidence that policies setting "donor" as the default option (an opt-out rather than an opt-in policy) dramatically increased the proportion of people who effectively consented to become organ donors—should the situation arise (34). Parts of the UK are now enacting legislation to move towards an opt-out system.

Default settings could also be used in other strategies, from automatically enrolling workers in health insurance coverage, to promoting the consistent use of best practices and cost-effective care. For example, prescription medications represent a large part of health care costs in the United States. Despite widespread substitution of generics for brand name drugs, it is estimated that more than $9 billion per year could be saved if substitution were even broader (269). Educating or incentivising prescribers to use generic drugs can be expensive and may lead to only moderate

changes in prescribing behaviour. But dramatic and sustained improvements have been seen with electronic generic substitution support, in which a prescription for a brand-name drug defaults automatically to a cheaper alternative.

At Vanderbilt University Medical Center, the proportion of generic prescriptions increased from 32.1 percent to 54.2 percent over a two year period following the change in default (197). Two years after the change, the proportion of generic prescribing remained significantly higher for prescriptions using the system (58.1 percent) than for hand-generated prescriptions (37.4 percent), leading to substantial cost savings.

Salience

Because people have limited cognitive resources, their choices are heavily influenced by what their attention is drawn to, and that is often whatever is novel and relevant (18). As a consequence, people often make important decisions on the basis of a single criterion, ignoring other relevant material.

The implication of this finding is that interventions can change behaviour by making other important dimensions salient as well. The growth in ineffective health spending has renewed pressure on health professionals to practice cost-effective care. But even though physicians' choices account for a large proportion of health care spending, many fail to take information on costs, including cost-effectiveness calculations, into account when they choose among different diagnostics and treatments.

To some degree, this lack of concern about costs among physicians has been driven historically by payment incentives that did nothing to discourage the ordering of expensive tests and procedures. However, in an era of accountable care, where there are incentives to meet cost and outcomes targets, physicians' consideration of cost will become increasingly important. In this context, it is

interesting to note that when salient price information has been provided to physicians, the total cost of tests ordered has fallen, compared to control groups.

In one study the average reduction in the total cost of tests ordered per patient was 31 percent in a group of providers who received information about the price of tests, relative to the control group (270). Similarly, presenting cost data alongside quality information that was easy to interpret improved the likelihood that patients would choose high-value hospitals, rather than simply assuming that high cost was equated with quality (271).

Without accompanying quality information, a substantial minority of patients shied away from the low-cost option, presumably because they automatically associated low cost with low quality. The study participants who saw quality as well as cost information were one-half to one-third more likely than the group who only considered cost information to equate high cost with high quality.

Priming

The finding that simple environmental cues can have powerful influences on subsequent behaviour encourages general thinking about how to modify the physical environment in ways to encourage better choices. For example, a number of schools, workplaces, and supermarkets are experimenting with modifications to cafeterias in an effort to prime people to make healthy choices. Some are displaying fruit prominently at checkouts (30). Our team has demonstrated how hand hygiene compliance (HHC) can be improved by olfactory primes. Appropriate HHC is the single best strategy to reduce the enormous cost burden associated with hospital acquired infections.

Affect

Because many medical decisions involve affective states such as fear, anxiety, and pain, decisions with long-term consequences may be made on the basis of very transient feelings. For example, a patient may decide to go ahead with a further course of debilitating, and expensive, chemotherapy

for life-limiting cancer. This decision may take place in a doctor's office only a few minutes after the patient has received bad news, even though in less emotional states many people trade length of life for a higher quality death (272). Such decisions can have large cost implications because care near the end of life consumes a disproportionate share of health care costs (273). Loewenstein has suggested that in situations characterised by dramatic fluctuations in individual preferences, people should take a certain amount of time to deliberate - allowing them to experience a range of affective states before making a decision that has lasting consequences (109).

Commitments

Many people are aware of their lack of willpower and try to circumvent it. We set goals to encourage behaviours that have both health enhancing properties but can have significant cost consequences (to smoke less, to eat less, to exercise more). Commitment devices *(*such as a gym membership) lock people into a course of action that they might not otherwise choose but that produces a desired result. The cost of smoking is significant with the Centers for Disease Control and Prevention estimating that smoking costs the US economy approximately $193 billion per year, with $97 billion in lost productivity and $96 billion in health care expenditures (274). Many smokers continue their habit in spite of a desire to quit (it is estimated that less than 5% of quit attempts are successful) (111). Smokers attempting to quit have long used commitment devices, but these can be strengthened through the insight that such devices usually become more effective as the costs of failure increase.

A successful example of a scheme that enhanced smoking cessation is the Committed Action to Reduce and End Smoking (CARES), a well-publicised commitment savings program implemented in the Philippines (215). In this program, smokers voluntarily deposit funds in a savings account for six months, after which they take a urine test for nicotine. If they pass, their money is returned to them. Otherwise it is given to charity, stimulating the powerful automatic force of loss aversion.

Smokers who participated in the program were 3 percentage points more likely to remain abstinent at six months compared to a control group, and this effect persisted in a surprise test of abstinence at twelve months.

Ego

People have a psychological need to maintain a positive self-image, which leads them to act in ways that make them feel better about themselves. This is caused in part by automatic impulses to behave in ways that enhance social status and that allow individuals to compare themselves favourably with others.

Rankings of the performance of physicians or hospitals are becoming increasingly familiar and can be responsible for pushing up standards. No person or institution wants to be at the bottom of such a ranking. Publishing cardiac surgery mortality data in the United Kingdom led to decreased risk-adjusted mortality, with no evidence that higher risk patients were being prevented from undergoing surgery (191).

There is little evidence of how ego effects can be played on to increase the provision of cost-effective care. However, more could certainly be done to recognize physicians, hospitals, and payers that provide high-quality, cost-effective services. The tendency for some physicians, hospitals, and whole regions to spend more money than their peers, while achieving the same outcomes, should be more widely presented as inferior performance (4)

Discussion

This Chapter focuses on a specific policy challenge and investigates how Mindspace can be used to understand both contributory behaviours as well as helping support intervention design. The health spending crisis is a problem facing many health systems - but is most pronounced in the United States. In attempts to slow the growth of health spending, there is ongoing debate about what

combination of policy tools can deliver the right balance of quality, access, and cost-effectiveness. Policies that change the environment or context in which decisions are made and 'nudge' people in particular directions have received little attention in the past. However, with health expenditures still rising in many countries - despite the widespread implementation of conventional policy levers such as information and incentives - these policies are now capturing the interest of policy makers and health care providers.

Traditional tools are and will remain important, but they have been associated with limited success. Undoubtedly more could be done with different combinations of traditional policies, or by implementing them more rigorously. But for health systems facing unsustainable spending increases, approaches based on behavioural economics offer a powerful set of new and enhanced policy tools. Cognitive biases can be used to understand why health spending may be increasing but Mindspace can be used to both understand and design interventions. Mindspace approaches described in this chapter have an untapped potential and may powerfully complement traditional policy levers. As the crisis of cost control becomes ever more pressing, there is a need to explore all possibilities and behavioural insights may provide some of the answers.

I now turn to the primary research I have undertaken as part of this thesis. For each of the research studies I have started with prominent healthcare challenges and implemented and evaluated a Mindspace related intervention. I have approached each study using the approach described in Chapter 5.

Chapter 5

5. Designing Mindspace interventions in healthcare

Summary

Behaviour change is complex and attempts to change health-related behaviour are often unsuccessful. Interventions fail for a number of reasons but often do so as they do not take account of the available evidence or follow principles of successful implementation and evaluation. All to often there is a lack of a strategic approach to behaviour change and different models and methods are used in an uncoordinated way. Taking a more systematic approach to the planning, implementation and evaluation of interventions could lead to more favourable outcomes and enhance the cost-effectiveness of behaviour change programmes.

Clearly, no single method for behaviour change can be universally applied to reliably influence the full range of health related behaviours. Designing effective behaviour change interventions is complex and should follow a process that maximises the likelihood of success. It is generally considered that the process of designing a successful intervention should start with understanding the behaviours in question, and the drivers and barriers of the desired and/or maladaptive behaviours (275, 276). Only after knowing that a particular behaviour is driven by specific type of goal, impulse or habit can we determine what policies or nudges are most effective in the specific circumstances.

This chapter discusses a framework to design, deliver and evaluate behaviour change interventions that is used in the research studies reported in later Chapters. The 6 E's framework (encouraging, enabling, engaging, exemplifying, explore and evaluate) was introduced in the Mindspace report builds on previous work by the Department for Environment, Food and Rural Affairs (DEFRA). There is a need to do things better when designing behaviour change interventions. The poor

description and reporting of current behaviour change interventions produces challenges in scaling up interventions and also synthesising evidence from the field. Although recommendations have been made to enhance the delivery and evaluation of behaviour change interventions, a lack of detail in how to achieve this has hampered efforts. The 6 E's framework provides a salient aide to achieve improvements in the process and has been used in my intervention studies described in later chapters.

Introduction

The format of interventions and how they are implemented being critical to their success. Behaviour change interventions can be broadly defined as a 'coordinated sets of activities designed to change specified behaviour patterns' (46). Behaviour change interventions in healthcare are often complex (containing a number of interacting components and/or a variability of outcomes) and provide significant challenges to researchers, policy makers and practitioners (277, 278).

There are ongoing concerns that the 'scientific standards demanded for biomedical interventions are often ignored when the intervention involves behaviour change' (279). So while for pharmacological agents, the active ingredient is clearly specified and there is a high level of competence in the personnel prescribing and administering them, behaviour change interventions are often poorly defined and are in many cases delivered by people of unreported competence. To allow for repetition of any intervention and to facilitate wider implementation, precise specifications (e.g. the mode of delivery of the intervention, level of competence of delivery staff) are required. Interestingly a meta-analysis found that where intervention studies did not report an underpinning theory, benefits were smaller (280). The the UK Medical Research Council's guidance for developing and evaluating complex interventions has recently called for improved methods of specifying and reporting intervention content in order to address the problems of lack of consistency and consensus in behaviour change (277).

Michie describes the process of designing behaviour change interventions as first determining the broad approach that will be developed before working on the specifics of the intervention design (46). The National Institute for Health and Clinical Excellence (NICE) put forward three factors that were considered to be important in behaviour change interventions. First, researchers and policy makers should be as specific as possible about the content of the intervention. Second, we it needs to be spelt out 'what is done, to whom and in what social and economic context'. Finally, it

needs to be made clear what underlying theory will help make explicit the key causal links between actions and outcomes (281)**.** So if we take the example of an effort to improve vaccination rates we may decide that an incentive scheme is a potentially useful approach before then determining the specific intervention components (e.g level or periodicity of the incentive). Underpinning this decision making is the choice of one of many different behaviour change frameworks that are meant to facilitate the process of designing an effective intervention. In a systematic review published in 2011, nineteen different behaviour change intervention frameworks were identified from the literature (including Mindspace) (see Fig 5.1) (46). The choice of behaviour change framework will depend on a range of factors including familiarity and context and individual preference. It will come as no surprise that I have used Mindspace as the guiding framework that I have used in the research studies, but further details need to be provided on how this is used in practice.

The reason is that Mindspace (as defined by its nine different elements) does not in itself provide structured support in implementing successful behaviour change interventions. Even if the different Mindspace effects are well understood, policy makers and practitioners may not necessarily be able to design, implement and evaluate a behaviour change intervention. So in the Mindspace report we also provided support in using Mindspace interventions through the 6 E's framework, itself a modification of DEFRAs (Department for Environment, Food and Rural Affairs) '4Es' policy framework (published in 2008) (282). The original 4 E's framework set out to adopt a comprehensive and balanced approach to behaviour change to establish new and more sustainable ways of living by designing interventions that addresses both internal and external barriers to change (Figure 5.2). The 4Es - encouraging, enabling, engaging and exemplifying - were put forward as four actions that should underpin behaviour change strategies (See figure 5.2) (283). In the 6 E's, Mindspace also added in two supporting actions - Explore and Evaluate - to assist in designing and assessing interventions (see figure 5.3).

Figure 5.1: Different intervention change frameworks (from Michie 2011)

Framework	Author	Description
Epicure taxonomy	West 2006	Taxonomy of approaches designed to influence behaviour patterns
Culture capital framework	Knotts 2008	Framework of knowledge about culture change, offering practical tools for policymaking
EPOC taxonomy of intervention	Cochrane Effective Practice and Organisation of Care Review Group (EPOC) (2010)	Checklist to guide systematic literature reviewers about the types of information to extract from primary studies
RURU: intervention implementation taxonomy	Walter (2003)	Taxonomy covering a wide range of policy, practice and organisational targets aimed at increasing impact of research
Mindspace	Cabinet Office (2010)	Checklist for policy-makers aimed at changing or shaping behaviour
Taxonomy of behaviour change techniques	Abraham (2010)	Taxonomy of behaviour change techniques grouped by change targets
Intervention mapping	Bartholomew (20110	Protocol for a systematic development of theory- and evidence-based interventions
People and places framework	Mailbach 2010	Framework that explains how communication and marketing can be used to advance public health
Public health: ethical issues	Nuffield Council on Bioethics (2007)	Ladder of interventions by government, industry, organisations and individuals to promote public health.
Injury control framework	Geller 1990	Heuristic framework for categorising and evaluating behaviour change strategies aimed at controlling injuries
Implementation taxonomy	Leeman 2007	Theory-based taxonomy of methods for implementing change in practice
Legal framework	Perdue 2005	Conceptual framework for identifying possible legal strategies used for preventing cardiovascular diseases
PETer	White (in prep)	Comprehensive and universally applicable model or taxonomy of health interventions

Framework	Author	Description
DEFRA's 4E's model	DEFRA 2008	Process model for policy makers aimed at promoting pro-environmental behaviours in accordance with social marketing principles
STD/HIV framework	Cohen 2000	Taxonomy to expand the scope of interventions that can be used to prevent STD and HIV transmission
Framework on public policy in physical activity	Dunton 2010	Taxonomy aimed at understanding how and why policies successfully impact on behaviour change
Intervention framework for retail pharmacies	Goel 1996	Framework that presents factors that may affect retail pharmacy describing and strategies for behaviour change to improve appropriateness of prescribing
Environmental policy framework	Vlek 2000	A taxonomy of major environmental problems, their different levels and global spheres of impact, and conceptual modelling of environmental problem- solving
Population Services International (PSI) framework	PSI 2004	A conceptual framework to guide and help conduct research on social marketing interventions

Figure 5.2: DEFRA's 4 E's Framework

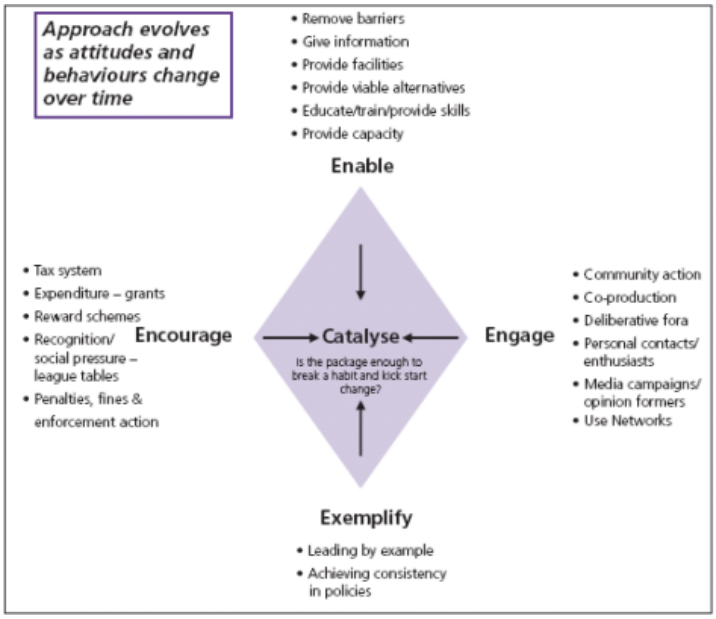
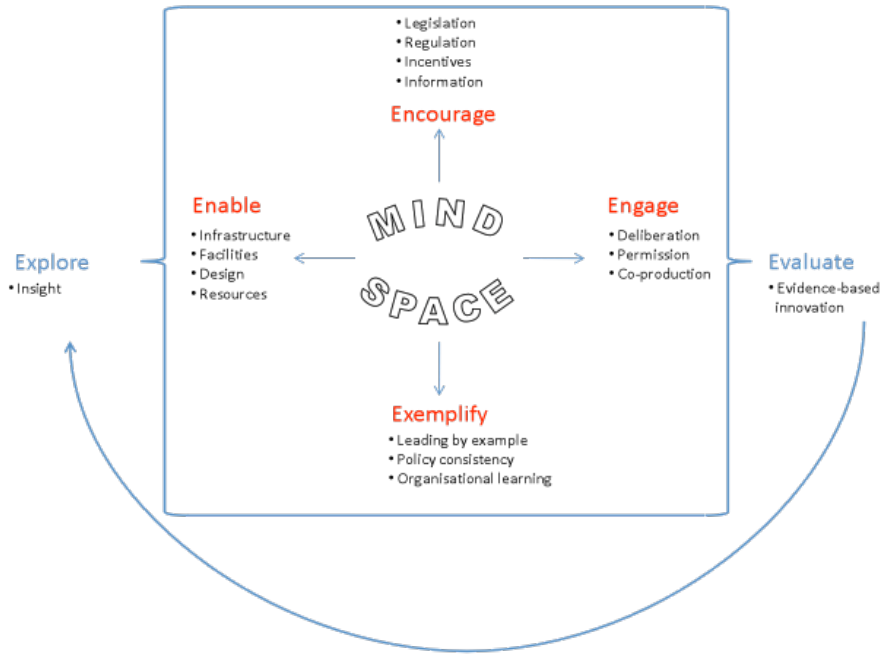


Figure 5.3: The 6 E's of Mindspace



The 6 E's categories

Explore

In seeking to change behaviour, those designing interventions (the choice architects) need to understand the behaviour that is being targeted. We need to define whose health we are seeking to improve and what behaviour we are seeking to change. If we want to reduce obesity levels in teenagers we need insight into the population being targeted as well as the reasons for their behavioural choices and current barriers to change. Certain behaviours may be more important for one particular demographic group over another. The first task is therefore to define an agreed set of behaviours and policy outcomes and then identify interventions that are likely to lead to these.

The second step in exploring the problem is to identify existing evidence. A range of resources provide access to good quality, timely evidence on the effectiveness of behaviour change interventions. The best starting point for determining an intervention strategy is to look for relevant

systematic literature reviews in order to identify interventions that have been previously applied and whether they have been successful or not alongside any relevant barriers and drivers. It is important to also look for evidence where it exists of unsuccessful interventions to reduce wasteful repetition. It is the recommended that the following electronic databases are searched (PubMed, PsycINFO, Google Scholar, Cochrane Controlled Trials Register, EMBASE). Search terms should include, but should not be limited to 'behaviour/behaviour change' and the intervention or policy along with relevant behaviours.

Whilst there should be a preference for research published in peer reviewed academic journals there is also an understanding that good quality, recent and original work may be found in the 'grey' literature (government reports, working papers, white papers) (284). Relevant articles should be selected on the basis of titles and abstracts and a subset chosen using inclusion criteria for full review. Documents should be reviewed, preferably by more than one (independent) reviewer and coded appropriately. The National Institute for Health and Clinical Excellence has written generic guidance on behaviour change interventions which provides some guiding principles (285).

The third step involves identifying a possible theory and intervention for testing. Before any substantial and costly evaluation is undertaken, the intervention must be developed to a point where it has a reasonable chance of success. Suggestions will frequently come from the literature review but will also come from examinations of existing theoretical behaviour change frameworks. A number of taxonomies of behaviour change interventions have been developed to report interventions and synthesize evidence and have varied in their approach by capturing either routes or targets to behaviour change or function and motivation (275, 278). Providing a rational for the intervention, how behaviour change is to be be achieved and measured need to be made clear at the outset. I have (maybe not unsurprisingly) chosen Mindspace as the broad framework for the

behaviour change interventions I have implemented and evaluated but I recognise that there are any number of other intervention change frameworks that could have been used (see Fig 5.1).

Finally, for very complex (and costly) interventions it is important to assess the feasibility of any intervention - potentially through modelling - as this will help foresee issues around acceptability, compliance, recruitment and retention (277). In the case of an evaluation of a classroom based adolescent sexual health intervention, feasibility studies demonstrated that the planned intervention was not appropriate for local cultural norms and it was replaced by an alternative programme (286).

Enabling

For effective behaviour change to take place we need to make it easier for people to make the right choice. If we do not have the right type of infrastructure and services in place then despite the best of intentions, people may be unable to change their behaviour. If we encourage people through a 'social norms' marketing campaign or an incentive programme to attend for a cardiovascular health screen (as suggested in the Next Stage Review report) (287) then we need to ensure that there is capacity in the system to assess extra patients. In a study we are undertaking following NIHR funding we are using different incentives to encourage diabetic patients to attend retinopathy screening. To enable this to happen we have had to create new clinics for target patients to be invited to attend.

We also need to ensure that we remove specific barriers to socio-demographic groups who may be disenfranchised if they can not access services. For example, consideration may need to be given to translating written invitations to appointments if there are language barriers or in the example of the vascular screening, if we find that working males are not attending appointments, we may enable take up if we provide appointments outside normal working hours. Practitioners coordinating and

delivering behaviour change interventions also need to be equipped with the necessary competencies and skills to support behaviour change.

In the course of my thesis I have become increasingly interested in behavioural design where insights from behavioural sciences are combined with design thinking to facilitate improved outcomes (I discuss this area further in Chapter 11). Marteau touches on this area in her 2012 discussion paper in *Science* where she discusses altering environments to constrain behaviours (referencing Tolman's law of least effort). Choice environments (which often incorporate physical spaces) can be designed to enable (and even encourage) behaviour change. So if we want to enable/ encourage people to take the stairs rather than the elevator or an apple rather than a chocolate bar in the cafeteria then we need to make the availability of that option in the environment more accessible. This increases the ease and likelihood of this option being used (25). In Chapter 8, I describe a study where I attempted to encourage hand-washing through the use of olfactory and visual priming. Hand-washing is only likely to happen though if there is adequate access to prominent hand-washing facilities (e.g. hand gel dispensers). So when thinking about introducing new interventions, thought needs to be directed at enabling factors in the physical environment.

Encouraging

'Encouraging' refers to what measures are needed to be put in place to provide incentives (in their broader sense) to encourage and disincentives to discourage a target audiences response. There are a huge number of models and theories of health behaviour and behaviour change. Whilst the focus here is on using Mindspace elements, the 6 E's framework can be used to think about more traditional attempts to influence behaviour. It may be useful to look again at the model presented at the end of Chapter 1, which explores how five different intervention categories (information, incentives, restriction, enablement and cues) impact on the different underlying regulatory systems (which incorporates both reflective and automatic processing) (See fig. 1.3).

This description of underlying regulatory processes governing behaviour suggests five key classes of interventions with *cues* predominately linked to 'nudge' and Mindspace' effects' are distinctly based on automatic regulatory processes. Once an established set of relevant interventions have been chosen, then they can first be tested with the target population with a focus on validating the intervention and underlying behavioural framework, capturing suggestions for refinements and creating the final framework for applying each intervention. Specific steps can then be taken to implement the policy or intervention.

Engagement

Interventions that attempt to change behaviour can be controversial. Focusing on the 'automatic system' can be more controversial still as people may not be aware that their behaviour is being targeted (see Chapter 10 for a deeper exploration of these issues). This is likely to open policy makers up to the charge of manipulation and raise concerns about freedom of choice and consent. Effective public engagement is necessary to provide legitimacy for the interventions introduced (55). Engagement can take place through a number of different fora including focus groups and 'deliberative forums'. In a healthcare setting, local research and ethics boards can provide a facility for receiving balanced feedback about the appropriateness of any interventions.

Exemplifying

In their book Nudge, Thaler and Sunstein defend a position labelled as 'libertarian paternalism (see Chapter 10) (4). Although sounding like an 'oxymoron' this term does neatly capture the conflict between these two ideals when considering Mindspace interventions in public policy (288). The charge of paternalism can be well made if the public are guided - potentially subconsciously - into one form of behaviour when policy makers exemplify a different behaviour all together. It is therefore important that those designing policy lead by example and that the actions of the policy

makers are consistent with the change being sought. If a hospital uses a social marketing campaign to reduce smoking, the impact of its message may be reduced if uniformed members of staff are seen smoking in the hospital grounds.

Evaluation

Evaluation is a key component of policy making and time and resources should be set aside for doing this properly. Comparatively few behaviour change interventions and policies have been evaluated through conventional randomised controlled trials and field studies. Whilst there may not always be a need for RCT's, rigorous evaluations are necessary to tell us what does and does not work when using behaviour change interventions. Evaluation of complex behaviour change interventions can however, be challenging given the long lags that often exist between action and effect and because of difficulties in confidently linking cause to effect in environments where many interventions may be in play at once. There will often be many confounding factors associated with evaluating behaviour change interventions that can make it difficult to determine causality and also impact. The evaluation of a norms based campaign targeted at teenage smokers may find it challenging to separate out the impact of price changes or other interventions that may have taken place over the same period of the intervention.

If the same rigour that is used to evaluate new pharmaceuticals and medical devices were applied to behaviour change interventions we would be able to provide powerful recommendations to policy makers on what does and does not work. In the past, the evaluation of behaviour change interventions has relied heavily on laboratory studies and secondary data. Recognising the limits of laboratory experiments, researchers are increasingly turning to well designed field experiments, which have been underused to date. Field experiments can maintain true randomisation in natural settings without knowledge on the part of the participant that their behaviour is being scrutinised. Field studies are particularly important with the finding that behavioural anomalies may be less

pronounced in the field than in the lab, although this is certainly not always the case (289). Whilst experimental approaches are always preferable, if they are not possible then observational or quasi-experimental studies may be required (286). Established approaches such as the Medical Research Council's framework for the evaluation of complex interventions can be used (290). It is also important to define the end-point of a behavioural intervention which Michie states should almost certainly be a defining behaviour, Very often non-behavioural health outcomes are used to measure an effective change in behaviour where there may also be many causal relationships (279).

Discussion

Policy makers and practitioners need to better understand the behavioural dimensions of their actions and interventions. Many behaviour change interventions are not grounded in either behavioural theory or the available evidence base. There is a clear need for behaviour change interventions to develop a sounder scientific basis and many commentators have made a very strong case for this (5).

Policy makers should take account of advice and evidence from a wide range of sources. The *Medical Research Council* has undertaken a programme of work to review theory-based approaches to health behaviour change, making suggestions about how they can be incorporated into the development of successful interventions (5). The CONSORT (Consolidated Standards of Reporting Trials) Statement is a 22-item checklist and flow diagram, intended to improve the reporting of randomised controlled trials (RCT's). Some issues have previously prevented it being applied in the context of non-pharmacological treatments (including for behavioural interventions). An extension of the Consort guidelines now provides recommendations for non-pharmacological treatments but still lacks some details in how to design all the components of an effective (291). There is also a need for policy makers and practitioners to consult with behaviour change experts who can provided further support.

In basic terms, Mindspace represents the tools for changing behaviour, whilst the 6 E's represent the wider framework through which Mindspace can be implemented and evaluated. I give an example of how Mindspace effects could be applied to the problem of teenage pregnancy (initially published in the Mindspace report) using the 6E's in Appendix 2 (52). In the following chapters I have used the 6E's to design, implement and evaluate behaviour change interventions.

Chapter 6

6. Redesigning the 'choice architecture' of hospital prescription charts

Summary

Background: Confusion surrounding information conveyed in hospital prescription charts accounts for many thousands of serious medication errors every year in the UK. Prescription orders are often ambiguous, illegible or use non-standard nomenclature. In an effort to reduce prescribing errors, initiatives are underway in the UK to enhance and standardise paper prescription charts that are used in the majority of hospitals. Standardisation is not the same as good design and the aim of this study was to incorporate behavioural insights into the user-centred design of an inpatient prescription chart (Imperial Drug Chart Evaluation and Adoption Study, IDEAS chart) and to determine whether changes in the content and design of prescription charts could influence prescribing behaviour and reduce prescribing errors.

Methods: A mixed methodology was used in the development and testing of the IDEAS prescription chart. The project was undertaken over a two year period from July 2011 at a London teaching hospital trust. The project comprised three specific phases (1) an exploratory phase consisting of chart reviews, focus groups and user insight gathering (2) the iterative design of the *IDEAS* prescription chart and finally (3) testing of final chart with prescribers, pharmacists and nurses using in-situ simulation.

Results: Substantial variation was seen between existing inpatient prescription charts used across 15 different UK hospitals. Review of 40 completed prescription charts from one hospital demonstrated a number of frequent prescribing errors including illegibility, and difficulty in identifying prescribers. Insights from focus groups and direct observations were translated into the design of IDEAS chart. In situ simulation testing revealed significant improvements in prescribing

on the IDEAS chart compared with the prescription chart currently in use in the study hospital. Medication orders on the IDEAS chart were significantly more likely to include correct dose entries (164/164 vs 166/174; p=0.0046) as well as prescriber's printed name (163/164 vs 0/174; p<0.0001) and contact number (137/164 vs 55/174; p<0.0001). Anti-infective indication (28/28 vs 17/29; p<0.0001) and duration (26/28 vs 15/29; p<0.0001) were more likely to be completed using the IDEAS chart.Following the iterative, user-centred development of the IDEAS chart, in situ simulation testing revealed significant improvements in prescriptions made using the IDEAS chart compared with an existing prescription chart already in use.

Conclusion: In a simulated context, the newly designed IDEAS prescription chart significantly reduced a number of frequent prescribing errors including dosing errors and illegibility. Positive behavioural change was seen without prior education or support indicating that frequent prescribing errors are rectifiable simply through changes in the content and design of prescription charts.

Introduction

The prescription and administration of medicines is the most common therapeutic intervention in healthcare setting (292). Medication errors are common (293). Such errors are of concern, as they can have a significant impact on clinical outcomes and come with a heavy cost burden (294). Given the impact of medication errors, efforts have been directed at identifying when they occur and how they can be avoided (295, 296).

Medication errors are generally classified by the stage at which they occur: prescribing, dispensing or administration (297). Safe and effective prescribing of medications requires the 'identification of the need for a drug and selection of the correct drug, together with the route, form, dose, frequency and duration, for the individual patient' (298). Prescribing has been identified as the stage at which most errors occur and is thus an important target for improvement (292, 299). Prescribing errors are a common occurrence in hospital inpatients, affecting an estimated 7% of medication orders, 2% of patient days and 50% of hospital admissions in hospitals using paper-based prescription charts (300).

The majority of NHS hospitals continue to use traditional paper prescription charts for hospital inpatients; these are used both for prescribing and to record the administration of medicines (301). Concerns have been raised about the contributory role of poorly designed prescription charts in facilitating prescribing errors (302). While a standardised in-patient prescription chart exists for Wales, hospitals across the rest of the UK have different charts often with very different features. The UK Academy of Medical Royal Colleges (AoMRCs) released guidelines in 2011 detailing an expert panel's view of the essential components of a safe and effective chart and there has been support by a number of Medical Royal Colleges and organisations such as the General Medical Council for a move towards a national prescription chart in England (303). A recommendation from the General Medical Council-commissioned 'EQUIP' study recommended that 'a standard

drug chart should be introduced throughout the NHS', although there is little evidence to support this approach (304).

The tools traditionally used to support good prescribing are largely informed by the theory of 'rational choice' (305). This approach predicts that if prescribers are given the right information and training then they will reliably make good prescribing decisions. However, educational initiatives in therapeutics have often failed to demonstrate significant improvements in prescribing, (306) with prescribers regularly failing to follow basic prescribing instructions such as writing legibly, writing the dose clearly, and documenting the length of treatment (307).

A second strategy to change prescribers' behaviour could be in targeting automatic processing systems and altering the choice architecture of in-patient prescription charts. This paper describes the Imperial Drug Chart Evaluation and Adoption Study (IDEAS), which considered how the choice architecture (the design and content) of prescription charts could influence prescribing behaviour. While there is existing evidence that differences in prescription chart design can lead to significant variations in prescribing error rates, (298, 308) there is a lack of research into how a direct behavioural and user-centred approach to the design of paper prescription charts can influence prescribers' behaviour.

Objectives

To incorporate behavioural insights into the user-centred design of an inpatient prescription chart (Imperial Drug Chart Evaluation and Adoption Study, IDEAS chart) and to determine whether changes in the content and design of prescription charts could influence prescribing behaviour and reduce prescribing errors through an in-situ simulation.

Methods

Setting

The IDEAS study took place at Imperial College Healthcare NHS Trust (ICHNT), a large London teaching hospital trust with three main hospital sites. This trust operates a typical UK model for the prescribing, supply and administration of medication, in which prescribers handwrite medication orders onto a formatted inpatient prescription chart. The same prescription chart is then used by nursing staff to determine the doses of medications to be given for each patient, and to sign for their administration. Charts are routinely reviewed by pharmacists to check that medication orders are legible, legal and clinically appropriate. The existing chart in clinical use is here referred to as the ICHNT chart.

The multi-disciplinary project team comprised four physicians, two behavioural scientists, four pharmacists and two graphic designers. The project took place between August 2011 and September 2013 and comprised three parts: (1) an exploratory phase employing several strategies to identify problems associated with current prescription charts; (2) iterative design of the IDEAS prescription chart; and (3) in-situ simulation testing of the IDEAS chart in comparison with the ICHNT chart. The study was approved as a service evaluation within ICHNT; ethics approval was not required. Written consent was obtained from each participating healthcare professional. All data collected were anonymous and confidential.

Phase 1: Exploratory Phase

The initial exploratory phase employed several strategies.

First, a review of hospital prescription charts from across the UK was performed. A team of two physicians, one behavioural scientist and two design experts reviewed a convenience sample of 15 prescription charts from different hospitals and made a number of observations against specific criteria informed by the guidelines produced by the AoMRC (303).

Second, two physicians reviewed the anonymised prescription charts of 40 consecutive patients discharged from one medical and one surgical in-patient ward, assessing the charts against a predefined list of criteria including legibility of medication orders, completion of allergy status and usage of different sections of the chart (e.g oxygen prescription, once only medications).

Third, two focus groups were held. A diverse group of seven participants (two physicians, three hospital based pharmacists and two hospital based nursing staff) were recruited to each of the two focus groups to maximise the exploration of different perspectives. Each focus group was scheduled to last for 75 minutes and was moderated by a member of the project team. No reimbursement was paid and verbal consent obtained from participants prior to commencement. Audio-recording was undertaken using *RecordPad* software and transcriptions made. The focus group sessions were structured in two parts. The first explored participants' general perspectives on the prescribing process and opinions on prescription charts they had personal experience of using in clinical practice. The second part explored participants' views on different prescription chart design ideas presented to them by the moderator.

Finally, two designers with expertise in user research and insight gathering carried out three days of observations of physicians, pharmacists and nurses prescribing, verifying and administering medication, accompanied by a physician. Electronic notes of observations were made.

Phase 2: Design of IDEAS prescription chart

Two specific approaches were taken in developing the IDEAS prescription chart. Firstly, an iterative, user-centred approach incorporating insight gathering from the exploratory phase of the study was used in arriving at the final design templates for the IDEAS prescription chart. Secondly, the Mindspace framework was used to design interventions or 'nudges' to influence prescriber behaviour (52).

Phase 3: In-situ simulated pilot testing of the IDEAS prescription chart

SETTINGS AND PARTICIPANTS

A simulated patient case study was developed to test the main changes incorporated within the IDEAS chart. The case study included a request for two antibiotic prescriptions plus ten further medications to be prescribed. The simulated patient used in the case study also had a documented allergy with a specific reaction. The case was developed by a team of physicians and pharmacists and pilot tested on two physicians prior to formal testing. We aimed to recruit approximately 30 foundation level (junior) doctors over a four week period working at ICHNT (See Figure 6.1 for Consort flow diagram for study). No training was provided on the use of either chart, although all participants were already familiar with using the ICHNT chart in their clinical practice. To enhance realism, prescribers were approached on one of 5 hospital wards during the assessment period. Such in-situ simulation, physically integrated into the clinical environment, provides greater realism than similar simulations in an alternative environment such as a classroom setting (309). Completed prescription charts were audited against predetermined standards for safe and good quality prescription writing (Figure 6.2).

RECRUITMENT

Foundation level doctors from a single academic hospital agreed to take part in the study after reading an information sheet and having been given the opportunity of asking questions. Participants were randomised using a computer generated random number service (www.random.org) to complete either the IDEAS or ICHNT chart. The case study and completed prescription charts were then presented to a group of 4 pharmacists and 4 nurses. Pharmacists were asked to endorse the prescription chart as per their standard professional practice to explore whether the IDEAS chart affected these tasks. Nursing staff were asked to sign for the prescribed

medications as if they were on a morning ward round; charts were then examined to find out whether this was done correctly for the completed IDEAS and ICHNT charts.

Figure 6.1: Consort flow diagram for IDEAS study

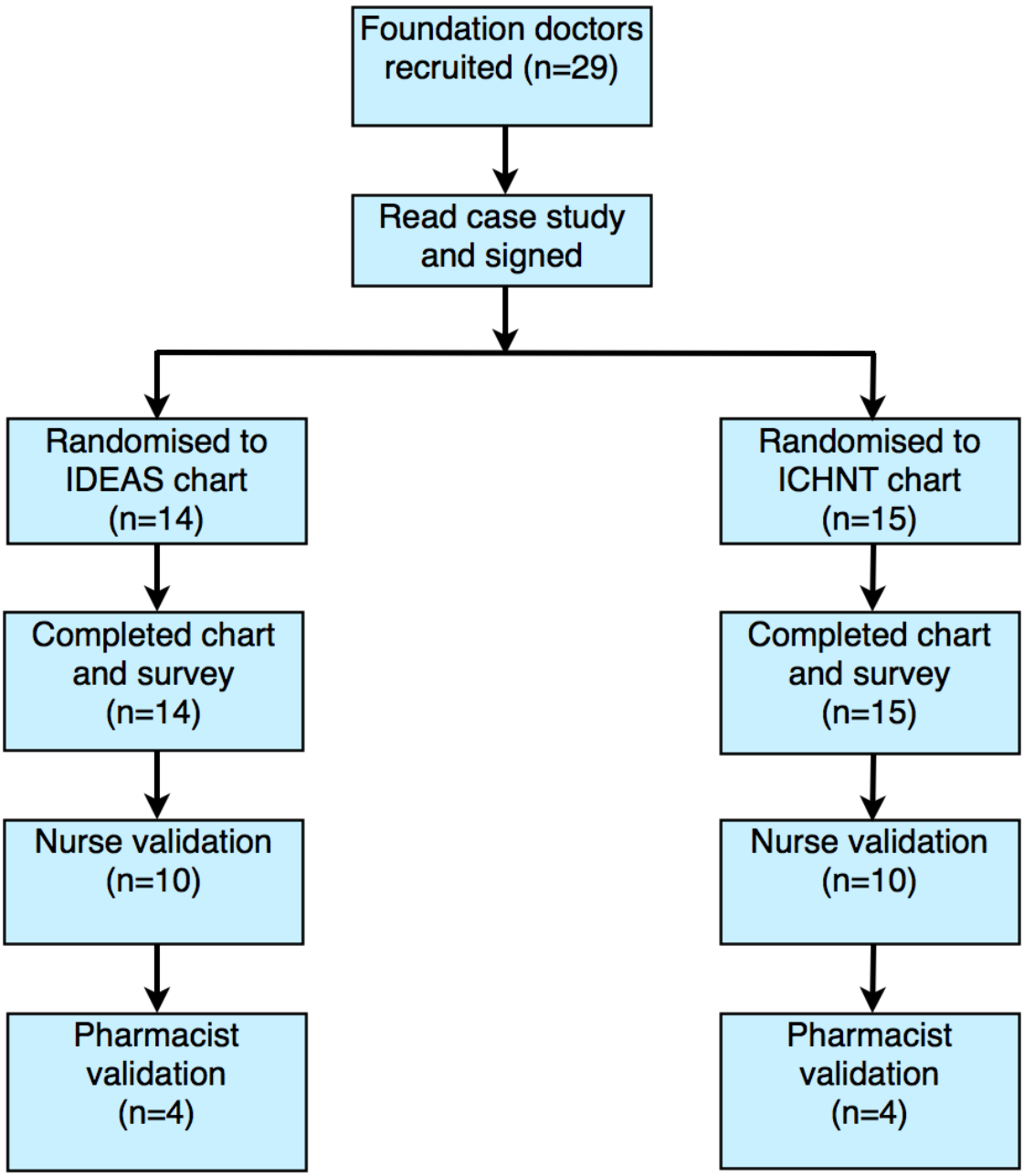


Figure 6.2: Standards for safe prescribing that completed charts were evaluated

Prescribing Standard	Description
Patient details	Name, ward, hospital number, consultant's name, date of birth, weight must all be stated clearly on the prescription
General prescribing principles	All prescriptions should be signed by the prescriber and, for each signature; the prescriber must print their name and bleep/ contact details. Where applicable the correct dose, frequency and indication should be stated
Allergy status	Both the allergy and type of reaction must be entered. If there is no allergy then this must be clearly stated
Regular medicines	The dose, route(s) and maximum dose and/or frequency of administration must be stated
As required medicines (PRN)	The dose, route(s) and maximum dose and/or frequency of administration must be stated
Antibiotics	The dose, route(s) and maximum dose and/or frequency of administration must be stated. All anti-infective prescriptions must also have an indication and a stop/review date documented on the prescription date
Adult venous thromboembolism (VTE) assessment and prevention guidelines	Prescribers should complete all relevant parts of the admission checklist

Analysis

In the exploratory phase, the different prescription charts in use across the NHS as well as the 40 completed prescription charts were subject to evaluation against the predetermined criteria. Focus group and observational data were thematically analysed and agreement sought between two reviewers over key findings. In reference to the charts completed in the insitu simulations, one physician and one pharmacy student separately examined the prescription charts. Data were entered into Excel and then transferred to SPSS (V.22.0. Armonk, New York, USA: IBM Corp) for analysis. For each of the different prescription tasks, we wanted to test whether there was a significant

difference between the IDEAS and ICHNT charts for a range of different outcome measures (eg, completion of information on indication or duration of anti-infectives, ability to identify the prescriber). Fisher's exact test with a Holm-Bonferroni correction was used to correct for false-positive results arising from multiple comparisons. This allows for a family-wise significance level of 0.05, while maintaining good power.

Results

Phase 1: Exploratory phase

There was a wide variety in terms of design and content between the 15 different NHS prescription charts examined (Appendix 3.1). Most charts used a booklet format; these ranged from six to twelve pages. All charts examined – including the ICHT chart - failed on at least one of the AoMRC standards for the design of hospital prescription charts.

A review of 40 completed prescription charts at ICHNT revealed that demographic information about the patient was generally completed to a high standard. Allergies were documented in 10 (10%) patients although the complete type of reaction was only fully completed for 3 (30%) of these. Overall, 22 of the 350 (6.3%) of the 'regular' medication orders and 10 of the 101 (9.9%) 'as required' medications reviewed were deemed illegible by the physician reviewers. In 313 (89.4%) of regular medication orders and 92 (91.1%) of as required medications, the prescriber could not be identified. Antibiotics were prescribed for 18 (45%) of the patients at some point during their inpatient stay. The indication was only documented for 21 of the 40 (52.5%) antibiotic orders prescribed and the length of course specified for only 8 (20%) of these orders (Appendix 3.2).

In our two focus groups, recurring themes included an explicit dislike across the professions for multiple different charts being used for the same patient. All professional groups felt that incomplete and barely legible medication orders were often 'tolerated' and that medications were

occasionally administered even if key details were missing. Doctors in the group felt that pharmacists would spot and rectify mistakes before any harm was caused. When the groups were asked for reasons underlying poor prescribing it was suggested that an important factor was that prescriptions were often completed by junior medical staff. Some prescribers commented that the format of the prescription chart made it difficult to enter all the details requested. For possible solutions, a checklist was seen as a good idea although opinions varied on what the individual components should be. It was widely agreed that more attention should also be directed at the design of the charts.

Insight gathering through the shadowing of prescribers, nursing staff and pharmacists in different clinical areas found that prescribers often appeared in a rush as they completed drug charts. Nursing and pharmacy staff were commonly observed having difficulty in identifying who was responsible for individual medication orders and then getting in touch with them with any queries.

Phase 2: Design of IDEAS prescription chart

Findings from phase 1 led to some specific design specifications for the IDEAS chart that complemented recommendations from the AoMRC report.

While some UK drug charts are in a fold-out format, it was clear from the observations that prescription charts were often used 'on the move' and so fold-out sections were not considered an appropriate design for the users. This was confirmed by a preference across the professional groups for a booklet format in our focus groups. All professional groups also disliked multiple and supplementary charts and the need for new charts to be written if patients stayed longer than a certain number of days. As a consequence of these findings, it was decided that the IDEAS chart would be in booklet format and be of sufficient length to avoid supplementary charts and repetitive transcriptions.

Prescription charts in use across the NHS have a range of colour schemes. The focus group explored participants' views of different colour schemes and it was generally felt that a blue background with white boxes was 'easiest on the eyes'. It was therefore decided that the IDEAS chart would have a blue background and white boxes leading to a 'writing in the white' principle.

There was no consensus among existing UK drug charts in terms of the ordering of the different sections (e.g. for regular, when required, once only medication and so on). Focus group participants across the different professional groups generally supported the use of separate sections but felt that little thought had been put into their ordering in charts they had worked with. It was decided for the IDEAS prescription chart that there should be an intuitive layout with separate sections for oxygen, anti-infectives and intravenous fluids also included. A cut out index was used so that people using the chart could quickly navigate to the relevant sections.

Mindspace interventions

A working group of clinicians, behavioural scientists and designers was established to think about how Mindspace could be applied to improving prescription chart design. It was agreed to incorporate the following element based interventions.

Salience

It is essential that certain parts of the prescription chart are completed fully and correctly and this may be achieved by increasing the salience of specific parts of the chart. One example is the completion of the allergies/sensitivities section. Clinicians are asked on prescription charts to enter both the allergy (e.g. penicillin) and the type of reaction (e.g. anaphylaxis) but often fail to do the latter. Allergy boxes on many prescription charts can make this difficult. In Figure 6.3, taken from an existing prescription chart, the prescriber is asked to enter the allergy and a description of

reaction but is given very little space to do so. The allergy box in the IDEAS chart is made more salient and encourages clinicians to enter both the allergy and the reaction type.

Many current prescription charts in use have 'all in one' boxes where prescribers are expected to enter a number of details together (e.g name/signature/contact number). All professional groups felt it was a good idea to provide more salient individual boxes for these details and this was incorporated across the IDEAS chart (Figure 6.4). Nursing staff and pharmacists described how they were often left to decipher unclear instructions such as the dose and units of the medications prescribed. There was general support for a system in which ambiguity was made difficult and prescribers were helped to 'go with the flow'. It was decided that the IDEAS chart should provide clear, well spaced out data entry boxes that facilitate legible prescriptions and reduced the potential for ambiguity.

Figure 6.3: Standards for safe prescribing that completed charts were evaluated

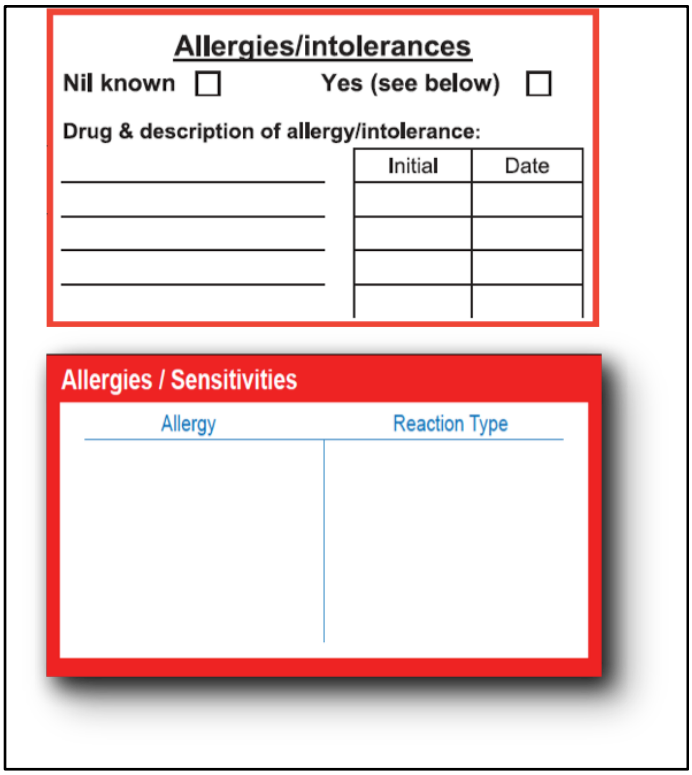
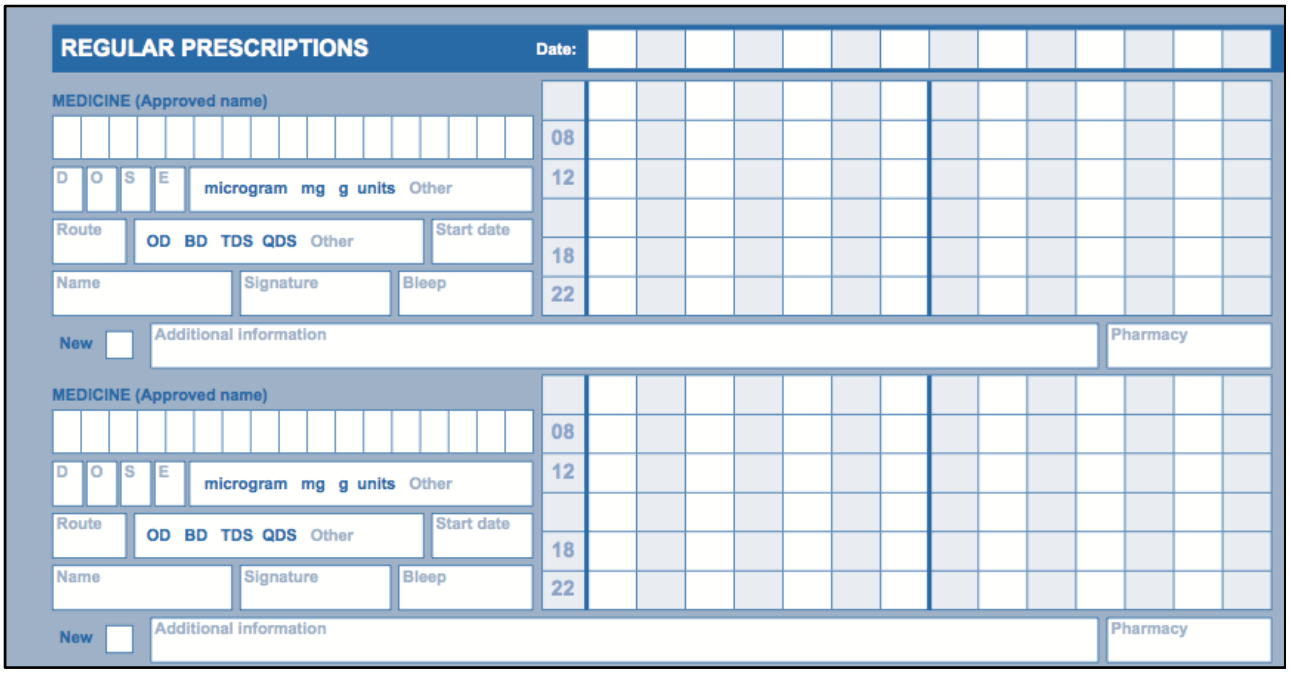


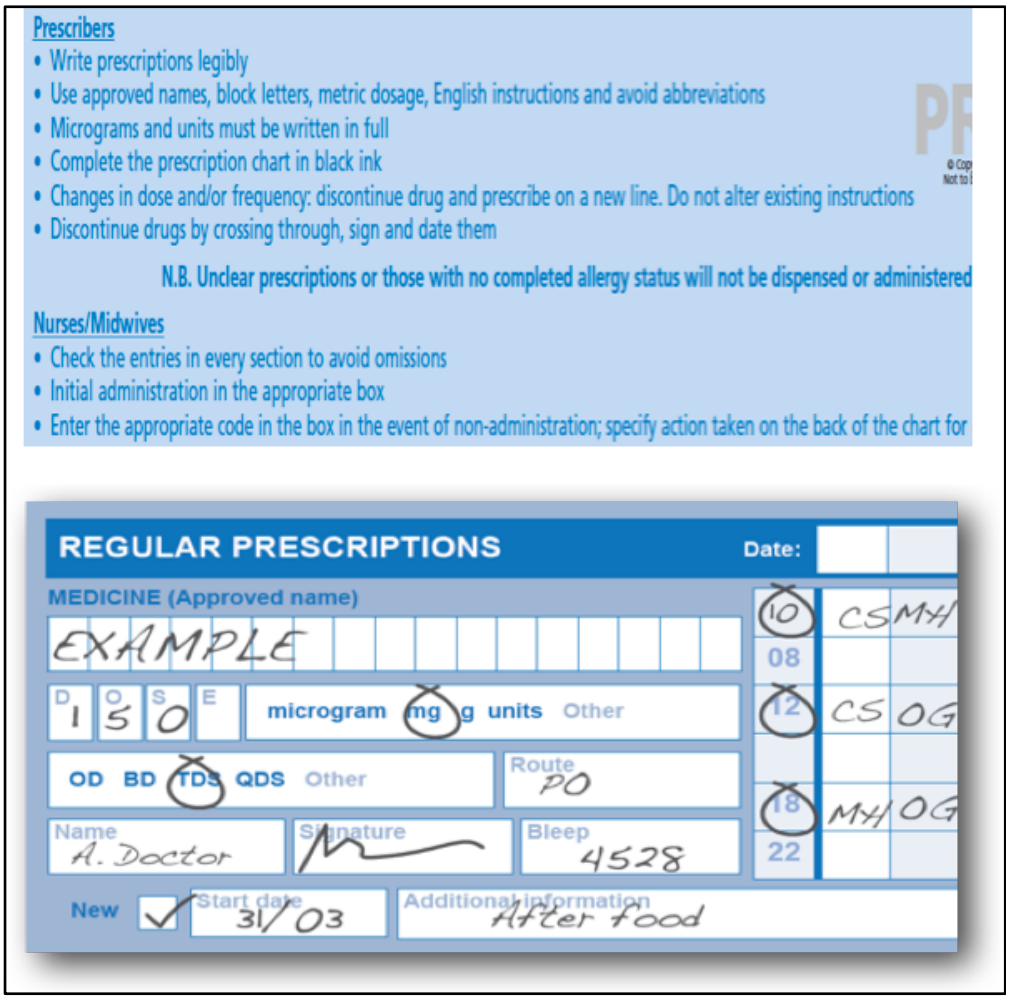
Figure 6.4: Individual data entry boxes in the IDEAS prescription chart



Priming

Human behaviour is greatly influenced by subconscious cues. Prescription charts in current use tend to provide clinicians with a long list of instructions as to how they should safely prescribe and administer medications. It was evident from our focus groups that these were rarely read. In the IDEAS prescription chart, traditional information based cues have been replaced with an example of how a prescription entry should look at the start of the regular prescription section with the aim of priming subsequent prescribing behaviour (Figure 6.5).

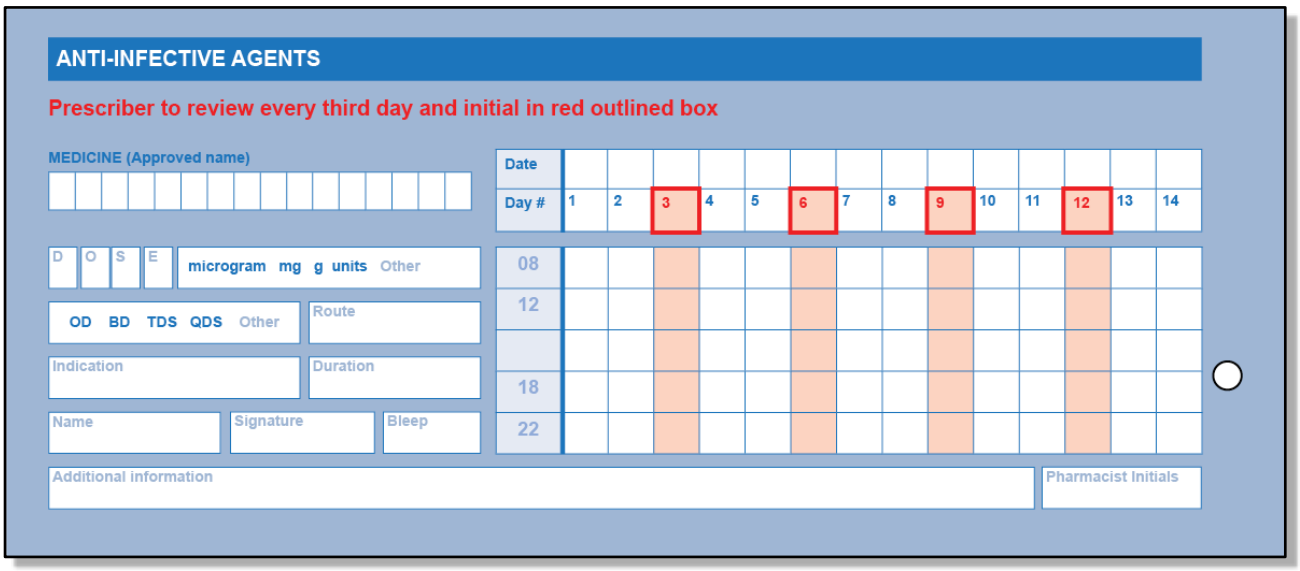
Figure 6.5: Instructions on prescribing found on an existing chart compared to 'priming' instruction from the IDEAS chart that encompasses all instructions



Defaults

It is well recognised that default settings have a powerful impact on our behaviour as people often go with the preset option (35). An area of significant concern where defaults may have an important influence is in the prescribing of anti-infectives. Once prescribed, anti-infectives can often continue for days after the optimum duration of treatment as a consequence of prescribers not actively stopping them. Excessive administration of antibiotics increases the likelihood of drug resistant infections (19). A separate section for antibiotic prescribing was incorporated into the IDEAS chart, with the default changed from one in which antibiotics continue to be given to one in which they will only be given if a clinician confirms that this is appropriate every 3 days (figure 6.6).

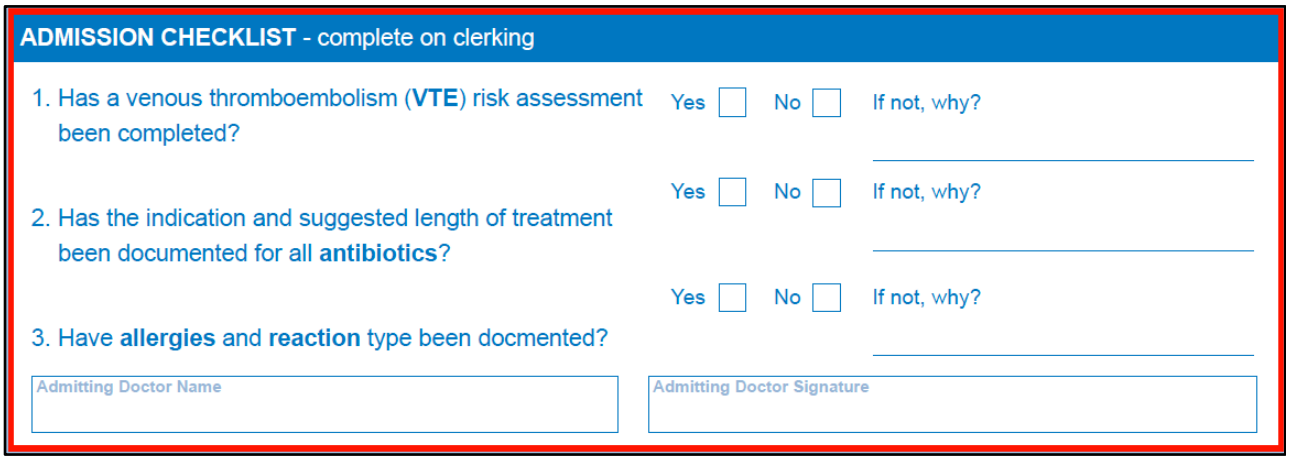
Figure 6.6: The anti-infective section of the IDEA chart where prescribers need to confirm every 3 days that the antibiotic should continue to be given



Commitment devices/Prescription checklist

Checklists have a long history of use across many high risk industries and a safe surgery checklist has been successfully implemented in hospital operating rooms (20). Checklists incorporate some of the key features of commitment devices and salience to provide checks and balances for safe prescribing. In the IDEAS chart, we have placed a checklist on the front page and have restricted it to three domains to ensure it does not cause an excessive burden on those completing it (Figure 6.7). The three areas the checklist focuses on problem areas that have been identified as being endemic in hospital based prescribing. They include a failure to complete the following: (1) reaction type of any allergy (2) suggested duration and indication for antibiotic courses (3) thromboembolism risk assessment and prescription of prophylactic treatment.

Figure 6.7: The checklist found on the front of the IDEAS chart



Phase 3: In-situ simulated pilot testing of IDEAS prescription chart

A total of 29 foundation year doctors working at one hospital completed the evaluation; 14 completed the IDEAS chart and 15 the ICHNT chart. There was no significant difference between the number of medications prescribed on the IDEAS chart compared to ICHT chart (164 of a possible 168 orders, versus 174 of a possible 180 orders; p=0.6).

There were key differences in the degree to which medication orders were completed correctly using the two different charts (Fig 6.8). Medication orders on the IDEAS chart showed a statistically non-significant improvement in legibility (164/164 vs 169/174; p=0.0611). Medication orders on the IDEAS chart were significantly more likely to include correct dose entries (164/164 vs 166/174; p=0.0046) as well as contact information of the prescriber - both printed name (163/164 vs 0/174; p=<0.0001) and contact/bleep number (137/164 vs 55/174; p=<0.0001). Current prescribing guidelines specify that the frequency of medication administration should be charted and this was significantly more likely (120/164 vs 15/174; p=<0.0001) on the IDEAS chart. There was no significant difference for the presence of signatures by prescribers (163/164 vs 171/174; p=<0.344) or in the documentation of allergy status and reaction.

Figure 6.8: Different completed features of medication orders using the IDEAS and ICHNT charts

		IDEAS Chart (% of 164 medication orders)	ICHNT Chart (% of 174 medication orders)	Significant difference at 5% level after Holm-Bonferroni (p-value)	IDEAS Chart shows significant improvement at 5% level? (p-value)
Was the prescription legible?	Yes	164 (100%)	169 (97%)	No (0.061)	No difference
Was the dose correctly entered?	Yes	164 (100%)	166 (95%)	Yes (0.007)	Yes (0.0046)
Was the prescriber's signature entered?	Yes	163 (99%)	171 (98%)	No (0.623)	No difference
Was prescriber's bleep number entered?	Yes	137 (84%)	55 (32%)	Yes (<0.0001)	Yes (<0.0001)
Was frequency of medications entered correctly?	Yes	120 (96%) (n=125)	15 (11%) (n=132)	Yes (<0.0001)	Yes (<0.0001)
Was the prescriber's name entered and legible	Yes	163 (99%)	0 (0%)	Yes (<0.0001)	Yes (<0.0001)

We measured key outcomes related specifically to prescribing of two antibiotics as part of the simulated case (see Figure 6.9). The IDEAS chart significantly outperformed the ICHNT chart in prescribers indicating the duration of length of antibiotics (26/28 vs 15/29; p=<0.0001) and also the indication of anti-infective use (28/28 vs 17/29; p=<0.0001) (Table 4).

Figure 6.9: Different completed features of antibiotic prescriptions using the IDEAS and ICHNT charts

		IDEAS Chart n=28 (% of total orders)	ICHNT Chart n=29 (% of total orders)	Significant difference at 5% level after Holm-Bonferroni (p-value)	IDEAS Chart shows significant improvement at 5% level? (p-value)
Is the duration of course documented?	Yes	26 (93%)	15 (52%)	<0.0008	Yes (<0.0001)
Is the indication for antibiotics indicated?	Yes	28 (100%)	17 (59%)	0.0001	Yes (<0.0001)
Is contact (bleep number) entered?	Yes	24 (86%)	9 (31%)	<0.001	Yes (<0.0001)
Is the prescriber name entered and legible?	Yes	27 (96%)	0 (0%)	<0.001	Yes (<0.0001)

Prescribers provided some feedback on perceived ease of navigation through the prescription chart that they had completed as well as their general opinion on the chart's design (see Figure 6.10). All prescribers completing the IDEAS chart (n=14) agreed or strongly agreed that the chart was easy to navigate and well designed, whilst 4 out of the 15 participants completing the ICHNT chart disagreed with the statements 'the prescription chart is easy to navigate' and 'the prescription chart was well designed'.

Figure 6.10: Prescribers perception on navigation through chart and its design

	The prescription chart is easy to navigate				
	Strongly disagree	Disagree	Neither	Agree	Strongly agree
IDEAS Chart (n=14)	0	0	0	7	7
ICHNT Chart (n=15)	0	4	2	4	5
	The prescription chart was well designed				
	Strongly disagree	Disagree	Neither	Agree	Strongly agree
IDEAS Chart (n=14)	0	0	1	8	5
ICHNT Chart (n=15)	0	4	2	6	3

Endorsements by nursing staff and pharmacists

Four pharmacists were asked to endorse one complete IDEAS chart and one ICHNT chart each with no significant differences seen between the different charts. Ten nurses were asked to sign for medications on one IDEAS chart and one ICHNT chart and again no significant difference was seen in between the charts.

Discussion

Professional organisations in the UK including the General Medical Council and Royal College of Nursing have called for standardised prescription charts to be used across the NHS with a standardised chart already used in hospitals across Wales (303). But standardisation and good design are not the same thing and suboptimal chart design may facilitate medication errors (308) (304). There is a clear case for good design and content of prescription charts and the guidance recently set by the AoMRC provides good suggestions (303). But there is much we could learn

about prescription chart design from the increased understanding we have of human judgment and decision making through recent applied research in the behavioural sciences and user-centred design.

Few studies have investigated the context or environment in which prescribing takes place even though it is widely recognised that hectic work environments and time pressures contribute to lapses in judgement and that the design of structured forms in other areas influences completion (310, 311). It is known that different prescription chart designs may be more likely than others to provoke error but little is known about how specific elements of chart design exert their influence (308). This is the first study to explore how behavioural and design insights can be used to improve prescription charts with the aim of reducing medication errors. The IDEAS project has demonstrated, at least in a simulated context, that applying behavioural insights to the design of prescription charts can lead to significant improvements in prescribing behaviour with no apparent problems among prescribers, nursing staff or pharmacists. These benefits were without any prior education or training using the IDEAS chart. It is notable that studies testing standardised charts have previously tended to include some training to support the implementation of the new chart (298). To reflect more usual practice, no such measures were taken in evaluating the IDEAS chart, indicating perhaps that a number of errors, like illegibility and poor prescriber identifiability, are rectifiable without the need for further extraneous interventions by addressing the choice architecture inherent in inpatient prescribing.

There is ongoing debate about the combination of tools that can deliver reduced numbers of prescription errors. Prescribing errors are often multifactorial with several active failures often conspiring together. The design of prescription charts is just one factor contributing to errors and the results of this study demonstrates that simple prescribing errors (legibility, ability to identify prescriber) were significantly reduced by applying behavioural insights and changing the design.

Whilst we have not shown that such errors would have led to actual patient harm, such cognitive lapses in prescribing undoubtedly have an impact in wider clinical practice.

We can use anti-infective prescribing as a lens to what good design of prescription charts can achieve. We know that anti-infectives are often incorrectly prescribed and this can lead to significant consequences such as inappropriate usage and prolonged courses. Inappropriate usage of anti-infectives can contribute to the emergence of antimicrobial resistance and healthcare acquired infections such as *Clostridium difficile* and the NHS has developed a strategy to ensure better antibiotic stewardship (312). A point prevalence study from 2008 found that 23.9% of antibiotic prescriptions were illegible and 29.9% incomplete (313). A key problem encountered with anti-infectives is that the rationale for usage and proposed course of treatment is often poorly documented. It is recommended by the majority of hospitals that in addition to standard requirements, all anti-infective prescriptions must have an indication and have a stop/review date (312), but current charts often do not encourage this. By having a dedicated anti-infectives section with separate entry boxes for indication and suggested length of treatment, 100% of prescribers completing the IDEAS chart specified the reason for prescribing them. This was a significant improvement when compared to the existing ICHNT chart where only 59% of prescribers specified the indication. No new education or training was required to shift this change in prescribing behaviour; it came about as a consequence of dedicated entry boxes and a separate anti-infectives section.

Despite the inevitable move towards electronic prescribing in the UK, progress has been slow and it is likely to be many years before electronic systems have taken over from paper prescription charts (301). In the meantime, significant improvements in prescribing could be realised by implementing some of the findings of the IDEAS project. Making small changes to the choice environment can be

used as an effective behaviour change mechanism, prompting individuals to change their behaviours in ways that make prescribing safer and more effective

There are several strengths and weaknesses of this study. The Imperial Drug Chart Evaluation and Adoption Study (IDEAS) chart was the result of an intensive exploration of stakeholders' views and observations of their behaviour in relation to the prescription and administration of medications. The design of the IDEAS chart incorporated cutting edge behavioural insights using the Mindspace framework. The use of in situ simulation testing enhances the realism of health professionals completing the chart without risking patient safety through the trial of an untested prescription chart. This study is limited by relatively small sample size and the use of simulation rather than a formal clinical evaluation. A number of parts of the IDEAS chart (checklist, separate sections for oxygen and intravenous fluid prescribing) were not tested as part of the evaluation. It was not possible to determine the relative contribution of the different features implemented.

Conclusion

The IDEAS prescription chart - at least in a simulated context - significantly reduced a number of frequent prescribing errors including dosing errors and illegibility. It also served to increase prescriber identifiability and enhance information documentation in relation to antibiotic prescribing. Significant and positive changes in prescribing behaviours took place without the need for extra training and education. A wider clinical evaluation is required but the learning developed through the IDEAS project could contribute to better designed prescription charts that facilitate improved prescribing.

Applying the 6E's to the IDEAS project

Explore	Thorough exploration of the prescribing process and barriers and drivers of safe prescribing was undertaken in the IDEAS project through engagement with end users. Techniques included a literature review, focus groups and work shadowing.
Enable	To facilitate behaviour change the IDEAS chart needed to be designed in such a way that encouraged safe and high quality prescribing. The final chart design enabled users to prescribe effectively whilst fulfilling the requirements set out in the recent AOMRC report.
Engage	The IDEAS project engaged front line staff through events that encouraged nurses, physicians and pharmacists to take part in design of the chart and in it's testing. The project team had input from across the different stakeholder groups that included pharmacists, physicians and nursing staff.
Encourage	The two approaches taken to change prescribing behaviour through the IDEAS chart were 1) using the Mindspace framework and 2) principles from user-centred design.
Exemplify	Senior clinical and academic staff were brought in to support the project.
Evaluate	Because of the obvious risks of introducing an untested chart into a clinical environment, the decision was taken to do simulated pilot testing first.

Chapter 7

7. 'Priming' hand hygiene compliance in clinical environments

Summary

Background: Effective hand hygiene compliance (HHC) is one of the most important procedures in preventing hospital-acquired infections. Traditional information/education based interventions have shown only modest and transient benefits to compliance. This study set out to investigate whether psychological priming (through olfactory and visual cues) targeting automatic brain processing could influence hand hygiene compliance

Methods: Randomised controlled trial set in a Surgical Intensive Care Unit (SICU). The primary outcome data involved observations – a mix of health professionals and service users were observed entering the SICU by two trained observers and their hand hygiene compliance was independently verified. Interventions included either an olfactory prime (clean, citrus smell) or visual prime (male or female eyes). The primary outcome measure was hand hygiene compliance measured by the visitor using the hand gel dispenser.

Results: At a 5% level there was significant evidence that a clean, citrus smell significantly improves HHC (46.89% vs 15.00%, $p = 0.0001$). Compared to the control group, a significant improvement in HHC was seen when a picture of 'male eyes' was placed over the hand gel dispenser (33.33% vs 15.0%, $p < 0.038$). No significant improvement in HHC was seen when a picture of female eyes was placed over the same hand gel dispenser (10.00% vs 15.00%, $p = 0.0626$).

Conclusions: This is one of the first studies that we are aware of that demonstrates how specific interventions using psychological priming could improve HHC in an actual clinical setting.

Thinking more generally about how priming could influence behaviour change could lead to new and improved interventions across public health.

Introduction

Nosocomial or healthcare associated infections (HAIs) encompass all infections transmitted to patients (and healthcare workers) as a result of consultations and procedures that take place in a healthcare setting. Such infections cause significant morbidity and mortality and are financially costly to patients and the healthcare system (314). The advancements made in treating many diseases over the last two decades has been undermined by infections transmitted during care and as a consequence the detection and prevention of HAIs are now central to many quality improvement programs (315).

Although not all HAIs are avoidable, many are preventable. Using evidenced based measures is a core component of strategies to reduce the burden of such infections. The UK epic2 national evidenced-based guidelines for preventing HAIs in NHS Hospitals were released in 2007 and provided comprehensive recommendations for preventing HAIs in healthcare settings based on best currently available evidence (316). The guidelines provide recommendations divided into four distinct interventions including hand hygiene (see Fig. 7.1);

Figure 7.1: epic2 recommendations on areas for intervention

	Interventions
1	Hospital environmental hygiene
2	Hand hygiene
3	The use of personal protective equipment
4	The safe use and disposal of sharps

Hand-washing and healthcare associated infections

Hand-mediated transfer of micro-organisms is a key factor in the development of HAIs as patients, visitors and staff can transmit resident and transient flora from their own hands onto debilitated patients. Effective hand hygiene compliance (HHC) amongst health professionals and hospital

visitors prevents cross infection in hospital and has been identified as one of the most important procedures in preventing HAI's. Unfortunately, compliance with recommended instructions on hand washing is often poor with observational and self-reported studies suggesting it rarely exceeds 50% in either a community setting or amongst health professionals in clinical settings (317-319).

HHC has been shown to be effective strategy in preventing the spread of infections such as influenza and *clostridium difficile* (320, 321). Numerous studies have shown the benefit to patients of improved HHC. Estimates based on meta-analysis suggest that in a community setting, improved HHC reduced rates of gastrointestinal illness by 31% and respiratory illness by 21% (322). The implementation of a hand-washing programme amongst young military personnel was associated with a 45% reduction in total outpatient visits for respiratory illnesses (323). A hospital wide campaign, with an emphasis on promoting bedside, alcohol-based hand disinfection saw hand washing compliance increase from 48% to 66%, which coincided with a reduction in nosocomial infections and MRSA transmission (317). How improvements in HHC are actually brought about is less clear and there are many examples of interventions that have had little to no sustainable impact on HHC (324). Traditional interventions have tended to rely on 'changing minds' and there is significant opportunity to use behavioural insights to enhance existing tools as well as thinking about new interventions to implement.

Behavioural insights and HHC

As has been discussed in earlier chapters, there are two broad terms there are two ways of thinking about changing behaviour. The first is based on influencing what people consciously think about and this is termed the 'cognitive' or 'rational' model. Most traditional interventions seeking to improve HHC have relied on educating and informing health professionals and service users about the importance of HHC and/or providing feedback on compliance. At best, such interventions have been met with only transient and modest improvements in HHC (325, 326). By encouraging people

to reflect on their behaviours, many interventions have failed to take account of the potential influence of more automatic drivers of behaviour that have recently been identified as being prominent in human judgment and decision making (18) and a key psychological determinant of several behaviours, including hand-washing (327).

The different Mindspace elements could have a potentially significant role in improving HHC. Social norms have been seen to influence HHC with the presence of other people in restrooms has been shown to increase hand washing (328, 329) and physician compliance with hand washing is influenced by other physicians behaviour (324). Affect has also been used to enhance HHC with a campaign targeting university students being more successful when the material instilled the feeling of 'grossness' about dirty hands rather than information related to spread of diseases (330). Whilst there is potential in many types of Mindspace interventions to enhance HHC (ward staff at a hospital in Wales have recently had to sign a commitment contract to improve hand hygiene (331)), herein we focus on how priming - the P in Mindspace - could be used as an intervention strategy to encourage HHC.

Priming - as described in earlier chapters - describes a process in which our behaviour may be automatically altered with little or no awareness if there is prior exposure to certain cues (e.g. words, sensations, smells or sights) (332). The interest in the potential role of priming in HHC was stimulated by studies demonstrating that people were more likely to keep their surrounding environment clean in the presence of an artificial detergent type smell (103) and that cues of being watched lead to observable changes in behaviour including in reducing littering (101, 102). Displaying images of eyes has been seen to cause people to act more pro-socially in both laboratory and real world settings and is thought to be related to the perception of being 'watched' (333).

In our research team, we had previously demonstrated the impact of a clean disinfectant smell (an olfactory prime) on hand hygiene compliance in a simulated clinical context (334). In this study,

165 novice healthcare providers examined a standardised patient (a professional actor playing the role of a patient). 79 of the participants were exposed to a fresh scent delivered through a commercially available aroma dispenser, whilst 86 participants were exposed to the standard environment. HHC was tracked before patient contact using video surveillance. The HHC was significantly higher in the fresh scent group compared to the control group (80% vs 51%, $p<0.001$). These results suggested that hand hygiene could be significantly influenced by olfactory cues. I felt it was important to look at whether this effect carried over to actual clinical environments rather than just simulated ones. I also wanted to investigate how cues of being watched could influence HHC. Two studies are now described. Firstly, the impact on HHC of introducing a clean citrus smell as the intervention prime. Secondly, the impact of an image of a pair of eyes over the hand wash dispenser to introduce a perception of being watched.

Methods

SETTINGS AND PARTICIPANTS

All people entering the Surgical Intensive Care Unit (SICU) at a large urban teaching hospital. This included staff (including clinicians and portering staff) as well as external visitors. The study took place over defined sessions in a three month period over 2012-2013. The primary outcome data involved observations of HHC performed by two observers who were sited at a discrete distance that allowed clear views of the area without being obvious to those entering the ICU. One was outside the unit, the other inside so that they would be able to observe hand hygiene compliance at any time between entrance to the ICU and the actual patient room. The ICU has private (glass walled) rooms. There is a Purell container outside the main entrance and several inside the ICU before reaching the individual rooms. Each instance was coded as ‘washed hands’ / ‘did not wash hands’. Hand hygiene was defined as use of alcohol hand rub at any point between entry to the ICU

and entry to the patient's room. Ethical approval for the study was obtained (IRB Number 20090104-03).

RECRUITMENT

All entrants (both staff as well as external visitors) to the ICU are expected to comply with hand hygiene recommendations using a hand gel dispenser prominently placed by the entrance door (see Fig. 7.2). A randomized controlled trial was conducted. Twelve different sessions of three hour observations were undertaken with intervention category randomized using a random number generator (www.random.org). Four sessions of observations were undertaken for each of the different intervention arms (control, olfactory prime, visual prime) (See Figure 7.4 for Consort flow diagram) To try and account for different staff/visitor mixes, all observed sessions took place between 9am to 5pm on week-days. A 24-hour break was held between individual sessions.

Figure 7.2: Entrance to the Intensive Care Unit



INTERVENTIONS

O*lfactory prime*

During this intervention, visitors to the ICU were exposed to an olfactory prime (clean citrus smell) that was introduced to the environment through a commercially available aroma dispenser (ScentAir, Charlotte, NC, USA). The choice of the specific fragrance was decided upon in an earlier pilot of this study where a group were asked to identify the 'cleanest and freshest' smell from a selection of ten. A minimum twenty four hour break between sessions ensured dispersal of any artificial scent.

Visual prime

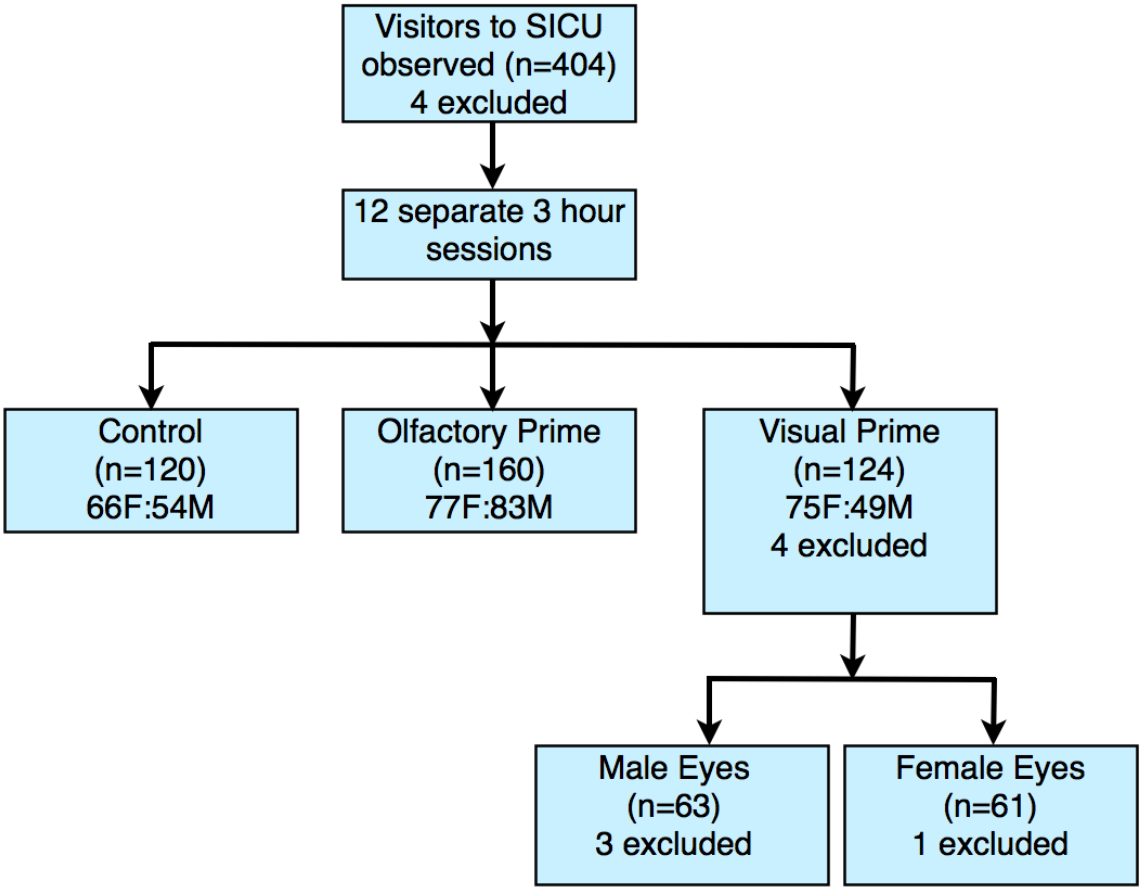
During this intervention visitors to the ICU were exposed to a picture of eyes that were prominently displayed above the gel dispenser. In half the sessions we used a picture of female eyes and in the other half a picture of male eyes (see Figure 7.3). The use of middle aged male eyes was also motivated by the observation in a study by Bateson where such eyes had the strongest effect on cooperative behaviour compared to younger male and female eyes.

Figure 7.3: picture of male and female eyes that were displayed above the hand gel dispenser





Figure 7.4: Consort flow diagram for Priming study



Analysis

The data involved a binary outcome variable (washed hands/didn't wash hands) potentially depending on two variables of gender (male/female) and intervention (none/scent/male eyes/female eyes). To analyse this, we divided the interventions into three (yes/no) binary variables in order to perform a logistical regression, testing whether each of the coefficients were significantly different from zero. Logistic regression analysis was undertaken using gender as a covariate for two reasons: First, we sought to eliminate gender as a confounding variable: to account for the possibility that females wash their hands more often **(340)**. Second, to observe potential interactions between the variables: illustrating whether males and females had a different reaction to the interventions. The

criterion for statistical significance was set at the 5% level. The regression model's goodness-of-fit measure was McFadden's Pseudo R-Squared – the theoretical range is $0 <$ McFadden Pseudo $R^2 < 1$, but as a rule of thumb, the model has an excellent fit when $0.20 <$ McFadden Pseudo $R^2 < 0.40$. The model's McFadden's Pseudo R-Squared = 0.28, which reveals a very good fit.

Results

A total of 404 individuals were observed entering the ICU over the period of observation. In the control group, 120 ICU entrances were observed, of which 18 performed hand hygiene (15.00%). In the control group, there was a higher rate of HHC in females but this was not statistically significant (19.70% vs. 9.26%, $B = -0.88$, $SE = 0.56$, $p = 0.119$). There were 160 people observed entering the ICU who were exposed to the olfactory prime and they were significantly more likely than the control group to wash their hands (46.89% vs. 15.00%, $B = 1.48$, $SE = 0.39$, $p = 0.0001$). There was no significant difference between the rate of HHC between males and females when exposed to the olfactory prime ($B = 0.48$, $SE = 0.65$, $p = 0.455$). A total of 124 visitors to the ICU were exposed to a visual cue of a pair of eyes positioned above the alcohol gel dispenser. Four were excluded due to incomplete data. When exposed to a picture of male eyes there was a statistically significant increase in HHC (33.33% vs. 15.00%, $B = 0.92$, $SE = 0.44$, $p = 0.038$). There was no evidence, however, of any significant impact of a photograph of female eyes on HHC (10.00% vs. 15.00%, $B = -0.28$, $SE = 0.58$, $p = 0.626$). There was no significant interaction observed with gender in response to the different interventions: scent ($B = 0.48$, $SE = 0.65$, $p = 0.455$), male eyes ($B = 0.11$, $SE = 0.86$, $p = 0.898$), and female eyes ($B = -0.73$, $SE = 1.26$, $p = 0.561$) (see Fig 7.4).

Figure 7.5: Hand hygiene compliance in visitors to the ICU

	Number of visitors	**Visitors observed to wash their hands**	**Effective HHC (%)**	**Control vs intervention *P***
Control				
	120	18	15.00%	
	66 female 54 male	13 5	19.70% 9.26%	
Intervention 1 – Olfactory prime				
	160	75	46.89%	0.0001
	77 female 83 male	40 35	51.95% 42.17%	
Intervention 2 – Visual prime				
	124	26	21.67%	
Male eyes	63 (3 excluded) 42 female 18 male	20 16 4	33.33% 38.09% 22.22%	0.038
Female eyes	61 (1 excluded) 32 females 28 males	6 5 1	10.00% 15.63% 3.57%	0.626

Discussion

Hand hygiene is an important behaviour to encourage in clinical environments to prevent cross-infections. It is recognised that rates of HHC are often suboptimal and this is again demonstrated in this study where only 15% of visitors to the ICU (including health professionals) were seen to wash their hands.

Despite a number of interventions being successful in improving HHC, it is generally considered that multimodal, multidisciplinary strategies will be necessary for long-lasting and sustainable behaviour change (325). Strategies to enhance HHC have tended to rely on encouraging health professionals and hospital visitors to reflect on their behaviour and have ignored important automatic drivers of behaviour related to hand hygiene.

This study provides significant evidence that the olfactory scent intervention, and the male eyes intervention, each had an effect on HHC. No significant interaction was seen with the female eyes intervention. Females were more likely to wash their hands than males in the control group (although this was nonsignificant), and this gender difference in HHC has been noted previously (16). It is an interesting finding that HHC was significantly enhanced when a photograph of male eyes was used, but not female. We are unsure of the reason for this but it may be that male eyes cued different feelings, thoughts or emotions than female eyes.

This study had several limitations. First, we did not ask those being observed why they did or did not perform hand hygiene or whether they had noticed the visual cue or smelled the olfactory cue. Second, by randomising our interventions by days (and times) we may have inadvertently had different mixes or volumes of visitors entering the SICU depending on the day or time of observation. Third, we did not identify what percentage of people observed entering the SICU were staff or external visitors, which may be important as some differences in HHC may exist between the different groups. Fourth, the picture of the male eyes shows more facial musculature, including a lowered corrugator which is an expression of anger/threat. The use of such middle aged male eyes was motivated by the observation in a study where such eyes had the strongest effect on cooperative behaviour compared to younger male and female eyes (326). Therefore, cautious interpretation seem warranted and future research will have to examine the potentially variable effect of different types of eyes and facial expressions (e.g., soft looking male eyes or mean looking female eyes).

While it has previously been suggested that automatic responses to the presence of specific cues (e.g. smells or images) could bring the cleaning concept into consciousness most priming studies, however, have been based on artificial laboratory scenarios and whether priming encourages people to wash their hands in actual clinical environments is less well understood. These experiments represent some of the first studies to evaluate such influences in real world settings. Based on these preliminary findings there is potential for further priming interventions as they could be a powerful tool in encouraging HHC and other preventative health behaviours.

Conclusion

This is the first study that demonstrates that olfactory priming can improve HHC in an actual hospital setting. A significant improvement was seen in HHC when a picture of male eyes was placed over the hand gel dispenser but not female eyes and the reasons for this remain unclear. Further investigation should be directed towards identification of how priming interventions can potentially lead to advances in public health and patient safety.

Applying the 6E's to the testing of olfactory priming in HHC

Explore	A literature review was undertaken to explore both 1) the importance of HHC in preventing nosocomial infections and 2) the role of priming in influencing behaviour change in healthcare.
Enable	To facilitate HHC there needed to be appropriate hand-wash facilities at the entrance to the ICU. As can be seen in the picture in 7.1, the dispenser is displayed prominently and it was ensured that it always contained the appropriate gel over the period of the observations.
Engage	Priming can be a controversial area and full ethical and institutional board approval was given for the project. The idea for the project was also discussed with senior clinicians and patient representatives.
Encourage	The choice of priming as the intervention was based on 1) its novelty and 2) our previous findings from the pilot study
Exemplify	Senior clinicians and managers in the hospital have expressed the importance of HHC and were supportive of the project.
Evaluate	Randomisation was used to determine when interventions were used. There are some concerns about the Hawthorne effect of having people observe HHC but we chose the best possible option in the circumstances.

Chapter 8

8. 'Nudging' health behaviours through mobile communication technologies

Summary

Millions of people die in both the developed and developing worlds from preventable diseases such as diabetes, cardiovascular disease and diabetes (1). By adopting healthier lifestyles (e.g. stopping smoking, losing weight) and making the best use of the latest evidence-based healthcare, people can reduce their risk of premature morbidity and mortality. Governments and health care providers need more effective strategies to encourage healthier choices and increasing interest is being directed at the the potential role of new mobile communication technologies as a mode of intervention delivery to help people improve their health.

The way in which people communicate with each other has changed remarkably over the last decade. Clunky desktop computers have been replaced by portable laptops and fixed landlines by mobile phones. Mobile communication devices are widely used around the world with the number of subscriptions for mobile phones outstripping the population in many developed countries (335). Mobile technologies include mobile phones (such as the iPhone, Samsung Gallery, Blackberry Curve), tablet devices (such as iPads and smartbooks) and handheld music players and gaming devices (iPod, Nintendo DS). Of all the different information and communication technologies, mobile communication networks and mobile phones have reached more people than any others with their adoption said to be growing faster than any other consumer technology in history (336).

Even in lower income countries ownership of mobile phones is high (337). The popularity and portability of mobile phones and associated devices has seen them being increasingly considered in interventions that promote health and prevent disease (338). Mobile health (mHealth) is the term used to describe the use of mobile communication technologies to deliver healthcare and is a

rapidly expanding area. mHealth is made possible through the variety of technical functions supported by mobile devices, which include voice calling, short messaging services (SMS), video-conferencing, GPS services and internet connectivity (339, 340). Each year the capabilities of popular handsets grow, providing more opportunities for their use in healthcare.

A large number of mHealth interventions have been introduced to improve health outcomes and processes of care, ranging from relatively simple SMS reminders, to more complex interventions incorporating body sensors networks (341). Published studies have looked at the impact of interventions delivered through mobile devices including in the following areas; collection of clinical data, appointment reminders (342), delivery of medical test results, provision of health information and remote diagnosis (338). Increasingly mobile technologies are also being used to think about delivering interventions to support health behaviours (e.g. weight loss support, smoking cessation) and the management of chronic diseases (e.g. medication adherence support). The features of mobile technologies that make them suitable for behaviour change interventions in healthcare relate primarily to their portability, popularity and capabilities (343).

This chapter looks at the evidence for mHealth as it relates to behaviour change. I have become increasingly interested in this area over the course of my thesis and am excited at the opportunities for delivering Mindspace interventions through mobile technologies technologies. Firstly I look at the growth of mHealth in the developing world where there has been unprecedented growth in the use of mobile phones to connect populations (344). Millions of people across low and middle income countries (LMIC's) who have never had access to a landline or the internet, are now using mobile phones to make calls, send messages and go online. The focus of this part of the chapter is in categorising the different domains within mHealth and is as relevant to the developed world as the developing. This work formed part of a Lancet commission looking at technologies for global health (337). Secondly, I look at the role of mHealth in two pressing areas of public health -

smoking and obesity. I look first at how Short Messaging Service (SMS) or text messaging has been used in these areas before looking at next generation smartphone apps.

a. Categorising different digital health interventions in low and middle income countries: A systematic review of the literature

Introduction

Health systems in the developing world continue to face substantial challenges in providing high quality, accessible and cost-effective healthcare. Innovative solutions and approaches are being sought to reduce the current barriers preventing effective healthcare delivery. Increasing interest is being shown in information and communication technologies (ICT) that could help low and middle income countries (LMIC's) tackle a wide range of health, social and economic problems, but whose previous usefulness has been limited by high costs and poor access (345).

Mobile phones more than any other modern technology are widely used across the developing world. Solutions to close the 'digital divide' between resource rich and resource poor countries increasingly focus on these technologies that cost-effectively substitute for expensive fixed-line infrastructure and could ameliorate several of the challenges faced by health systems (345, 346). The most rapid growth in the use of mobile phones is now occurring in low-income countries, where they are being widely used to connect users to other people, information, markets and services. Most developing countries are experiencing an unprecedented increase in the number of users of mobile communication technologies, as well as a decline in the price of devices and associated services (347).

Digital health or mobile health (mHealth) is a dynamic and expanding field of research and practice defined as 'medical and public health practice supported by mobile devices, such as mobile phones,

patient monitoring devices, personal digital assistants (PDAs), and other wireless devices' (348). Digital health applications are being used across the developing and developed world to collect outcome data, deliver medication and appointment reminders, educate health workers, and diagnose disease.

Objectives

To undertake a systematic review of the evidence base for mHealth interventions targeted at the needs of populations in low resource environments and determine a taxonomy to categorise the different interventions into specific domains. There were two broad ways initially identified of doing this: either through the type of technology used (e.g. smartphone, SMS or camera) or the purpose of the technology. The decision was taken by the research team to focus on the function/ purpose of the interventions as that would be more useful in identifying emerging patterns in the field. All identified programmes were coded on accordance with the taxonomy developed.

Methods

I adopted a systematic approach to identify, appraise and discuss the available literature addressing the use of mobile delivered interventions within low resource settings (defined by World Bank criteria) targeted at health care professionals, patients and the public.

DATABASE SEARCH

Eligible studies were retrieved from a search of the established research literature with findings supplemented with reports from 'grey' literature. An inclusive string of free terms was developed to query PubMed, EMBASE, PsychInfo, Google Scholar and the Cochrane Library for research reports published from the 1st of January 2000 to the 1st of January 2012. In order to capture a broad category of interventions the search included investigation of specific devices (mobile

phones, smartphone and personal digital assistants), and different communication functions (short messaging service (SMS), multimedia messaging service (MMS), voice calls, GPS and camera function) in LMICs. Two reviewers (DK and MK) identified and retrieved eligible studies in which an intervention delivered through mobile communication technologies was the primary intervention component under evaluation. Primary outcome measures include any objective measure of health, health service delivery or use.

INCLUSION AND EXCLUSION CRITERIA

For the purposes of this review I was interested in any intervention delivered using mobile communication devices (wireless digital devices supported by mobile communication infrastructure e.g. mobile phones, tablet devices) that were targeted at low and middle income countries (as defined by World Bank criteria). mHealth interventions can take place through a range of delivery modes including SMS text messaging, voice calls, video and increasingly through apps. Within the scope of this review we included all intervention types that directly supported patients or healthcare providers in LMIC's - such as self care support, report monitoring, disease tracking, public health messages and point of care diagnostics. A broad range of study designs incorporating randomised controlled trials, cohort and case-control studies and descriptive case studies were included. Studies involving patients, the public and healthcare staff were eligible for inclusion.

Studies or reports were excluded if they took place in high income countries orwere not reported in English. Editorials, expert opinions and technical reports were also excluded.

SCREENING PROCESS

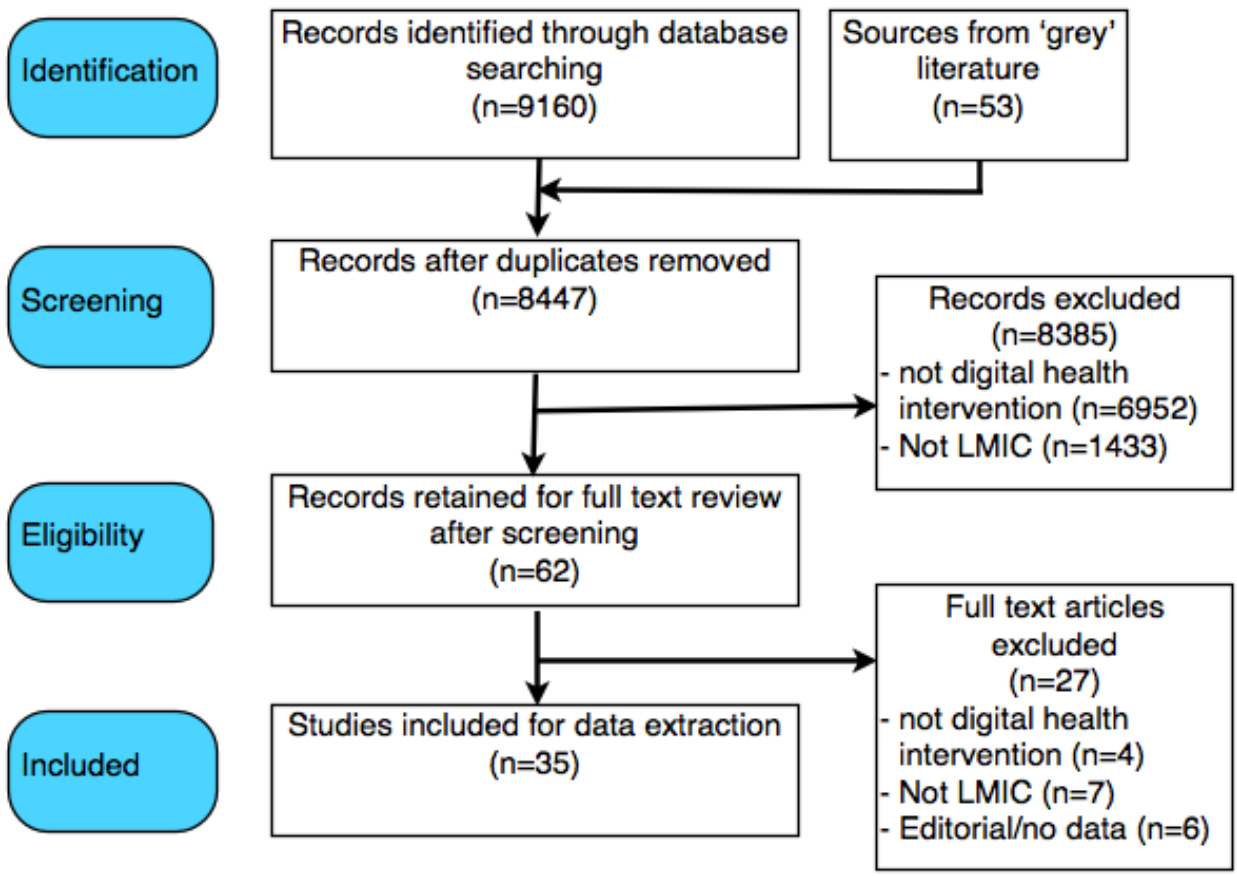
Screening of articles titles and abstract was performed by two reviewers (DK and MK). After initial screening, full text articles of potentially relevant studies and reports were retrieved and reviewed against the specific inclusion and exclusion criteria with disagreements resolved through discussion. Reference lists of included studies were scanned to identify other potentially relevant articles.

Results

DATABASE SEARCH RESULTS

The literature search yielded 9,212 articles from peer-reviewed journals and 53 web-based 'grey' literature links for review. Initial screening excluded 9,108 articles and 36 links. Further screening based on a more strictly defined set of inclusion and exclusion criteria excluded a further 27 articles. In total 35 articles met the inclusion criteria (see Figure 8.1). Information was extracted from eligible articles to provide the empirical evidence base for discussion. High quality evidence was sparse with only 9 Randomised Control Trials (RCTs) identified.

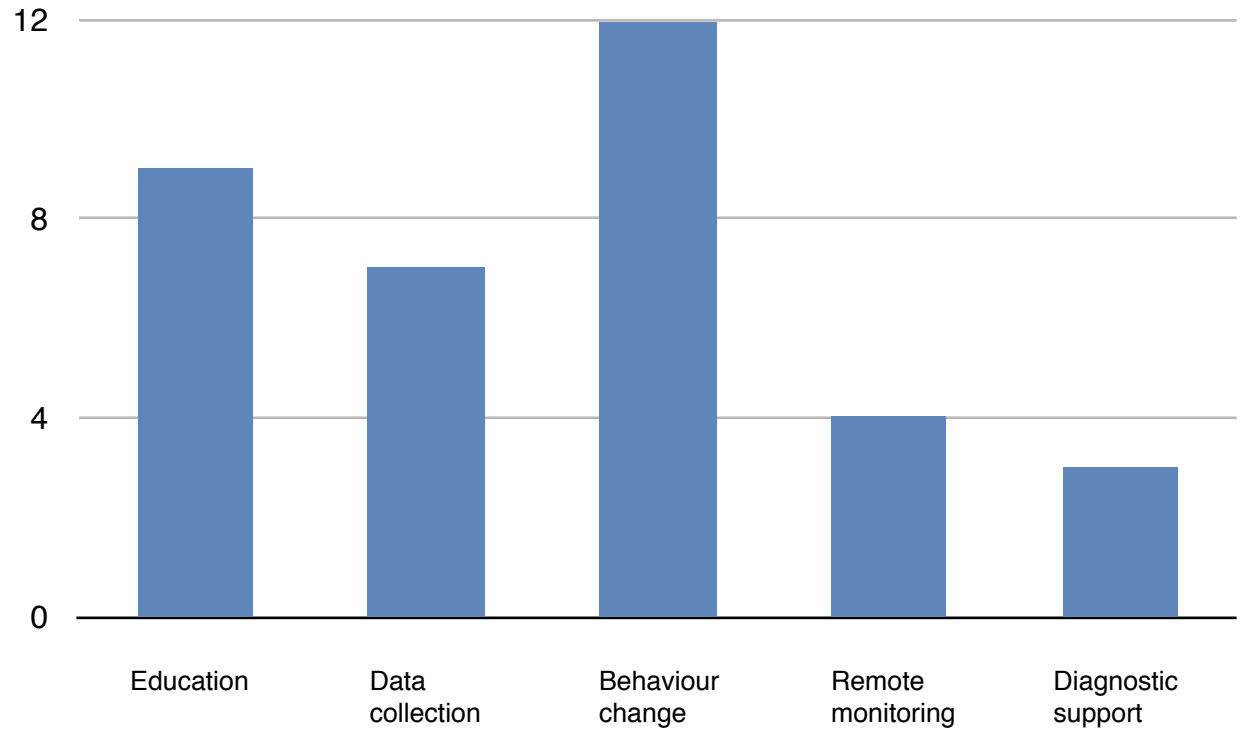
Figure 8.1: Database search results (as per Preferred reporting for systematic reviews and meta-analyses (PRISMA))



STUDY CHARACTERISTICS

Among included studies, a variety of intervention types were identified and categorised into 5 domains. The categorisation was determined following discussions with the wider research team and building on previous work in the area by the World Health Organisation (349). The five broad categories identified were: 1) education and clinical decision support, 2) remote data collection and analysis, 3) health behaviour change, 4) remote monitoring and integrated care and 5) diagnostic support. Among included studies, the most common intervention category was behaviour change followed by eduction/clinical decision support and remote data collection/analytics (See Fig 8.2). Trials varied considerably in terms of their aims, methodologies and outcomes and it was not feasible to perform a meta-analysis of results. In the remainder of this review, the literature is discussed according to the identified categories outlined.

Figure 8.2: Number of digital health interventions according to category



Education and clinical decision support

Providing safe and effective healthcare in developing countries is hampered by a shortfall in absolute numbers of health professionals as well as poor access to basic, practical information for those delivering care (350). Health outcomes for low-income populations could be improved by ensuring health workers adhere to evidence-based guidelines (351). ICT has transformed the training and support health workers in many countries receive (352), but uptake in low resource settings is hampered by poor access to the enabling technologies (353).

Mobile learning and support systems have been successfully implemented in developing countries (354). With little training, doctors in a residency program in Botswana were able to use smartphone applications (including drug reference and clinical decision-making tools) to access point-of-care medical information and self-directed learning materials (355). In Tanzania, clinicians using a mobile phone based management of childhood illness software application performed 85% of the steps required by the protocol compared to 64% by those using conventional methods (356). Limitations of m-Health interventions in this area include a lack of software interoperability across different handsets and the cost of software development and purchase of handsets (357).

Remote data collection and analysis

Collecting outcome data can be challenging in developing countries. Electronic centralised databases are now widely used to facilitate the submission and analysis of data from multiple locations with mobile platforms (like episurveyor and epicollect) providing two-way interactions where networked computers are not available (358, 359). In Ghana, birth attendants with low literacy levels were successfully trained to report postpartum haemorrage outcome data using an

SMS based reporting system (360). In Rwanda, a national electronic cell phone and web-based monitoring and evaluation system for the national antiretroviral treatment programme (TRACnet) was successfully implemented, enhancing the quality of information programme planners received (361).

Using digital platforms rather than pen and paper to collect epidemiological data can provide real time monitoring and yield cost savings (362). A sentinel surveillance programme was established in Madagascar to mobilise rapid responses to illness clusters of the insect-borne virus Chikungunya. Results demonstrated the feasibility of implementing surveillance system that transmits data on a daily basis at low cost and with good cooperation from staff (daily data transfer was estimated to be 89%) (363).

Behaviour change

There is good evidence to support the role of mHealth platforms in opening up new opportunities and channels to influence health behaviours. SMS text messages are now widely used in health promotion campaigns, with positive behaviour change identified in a number of intervention programmes evaluated (338, 339). A benefit of SMS intervention is that they can be tailored to individuals or specific groups, which has importance given that individualised interventions are more effective than standard messages (364).

In the developing world, SMS text messaging interventions have been evaluated in areas including antenatal health, breast health awareness and HIV prevention (365, 366). Project Masiluleke in South Africa is an example of health promotion campaign that provides users of a free SMS text message service with healthcare information and support with HIV self-testing. One documented outcome was a tripling of the average daily call volume to the national AIDS helpline (367).

Literacy and language barriers in developing countries remain a predominant problem in widespread implementation of health promotion strategies using mobile technologies. One solution is to provide a voice messenger service as in the MOTECH's 'Mobile Midwife Application' for prenatal support for the whole family (368) and as an educational tool for healthcare workers (369). The Freedom HIV Project in India engages participants, by the dissemination of HIV related information in the form of a free to download mobile phone games (370).

Remote monitoring and integrated care

Health systems in many developing countries are often too fragmented to meet the complex needs of users (371). Remote monitoring solutions offer new possibilities for managing patients in environments where access to hospital facilities and medical expertise is limited. Remote monitoring using mobile technologies have been defined as including applications that provide 'one- or two-way communications to monitor health conditions, maintain caregiver appointments and ensure medication regimen adherence' (370).

There is good evidence that mobile technologies can improve service delivery, monitor illness and improve stakeholder communication in high and middle-income countries. An increasing evidence base also supports their role in low-income countries. In a multisite randomised clinical trial of HIV-infected patients initiating antiretroviral therapy in Kenya, patients were randomised to a mobile phone SMS intervention or standard care. Patients receiving SMS support had significantly improved self-reported adherence to antiretroviral therapy compared with control individuals (62% vs. 50%). Viral suppression rates were also improved in the SMS support group (372). In this study the SMS intervention was inexpensive and human resource and training requirements were minimal. A further randomised controlled trial of SMS reminder interventions on adherence to antiretroviral therapy in Kenya also demonstrated a significant impact. 53% of participants

receiving weekly SMS reminders achieved adherence of at least 90% during a 48 week period of observation, compared with 40% of participants in the control group (373). An interesting adjunct to simple reminders is the SIMpill system (SimpillPty Ltd., Western Cape, SA) that attaches to standard pill bottles or blister packs and sends an SMS every time a bottle or pack is opened. In doing so it functions as a mobile phone SMS-based medical adherence support system that can cost effectively improve adherence to tuberculosis (TB) therapy and improve TB outcomes (374).

mHealth interventions are also being targeted at the problem of on-attendance at clinic appointments, which can reduce the efficiency of service delivery and outcomes. SMS reminders have the potential to reach large numbers of individuals at relatively little cost and has been shown to be effective in improving clinic attendance rates in high and middle income countries (375, 376). A cross sectional study in Uganda found that 79% of patients with HIV missing a scheduled appointment attended clinic following mobile phone recall (377). However, there was no control group in this study and absolute episodes of missed appointments were small (11%). There is little evidence of wider cost impact of m-Health interventions on health systems, although an evaluation of a group of applications for community health workers (CHWs) in Malawi found that the capacity of a tuberculosis treatment programme doubled (378).

Diagnostic support

Although a technology in its relative infancy, diagnostic tools delivered through mobile devices could broaden the ways in which people in low resource environments receive care. New functions and biosensors linked to mobile devices and networks can allow local providers to measure vital signs such as heart rate, respiratory rate and other medical calculations and sophisticated parameters like pulse oximetry and electrocardiography (379-381). A further example is mobile phone based clinical microscopy that could provide a cost-effective method for diagnosing haematological and

infectious diseases. A microscope attachment for a camera enabled mobile phone has been developed that allows for light and fluorescence microscopy. In addition to direct visualization of the slide, images can be sent to an expert reader for confirmation (382). Such technologies may not negate the need for expert advice and support, but may provide enhanced access to services, particularly in remote and rural areas.

Discussion

This systematic review of digital health use in LMIC's demonstrates a wide range of innovative utilities in areas including education and training, behaviour change and disease monitoring. Although the results demonstrate the potential for digital health in developing health systems, further high quality studies will be necessary to prove that such technologies can have a transformative impact on outcomes.

Mobile technologies have improved communication in LMIC countries, overcoming geographical boundaries that previously existed between different users. Currently the majority of mHealth activity occurring in low resource environments uses basic voice and SMS functionality. The possibilities of mHealth will continue to expand as the penetration of 'smart' phone increases, giving more people access to the internet and related capabilities. As would be expected, smartphone usage is lower in LMIC countries compared to developed countries but the gap is shortening (383). Industry analysts expect that almost all mobile phones will be smartphones by 2020, with prices falling as low as $10 for high specification models (384).

More smartphones, along with expanded network coverage and the advent of open-source platforms means that the role of digital health solutions in improving health systems in low-income countries is set to increase. Digital health applications may in future support community health workers making clinical decisions outside their competency levels or monitor treatments provided in a

remote village without a dedicated health centre. As yet, most of the innovations in mHealth in low income countries have not got past the pilot stage and have not been rigorously evaluated. This review demonstrated the need for further research, with only nine RCT's identified. Few programmes have gone to scale and implementation has tended to be fragmented and uncoordinated (385). More evidence is needed for funders and governments to invest in expanding these innovations. Despite the hope that mobile solutions can close the 'digital divide', barriers to their successful up-scale remain including in many places poor or unreliable infrastructure, lack of interoperability between devices and disengaged users. The failure of one simple step in the process can disrupt what is a promising innovation.

In the future, robust evaluations in the form of controlled trials and natural experiments are necessary with comparable outcome measures provided (386). In high and middle-income countries, digital health interventions have a growing evidence base supporting improvements in both clinical and process measures with significant learning from the experience of early work in the LMIC's (387). The development of an evidence base will be supported by a robust categorisation for digital health interventions that is as relevant for developed health systems as it is for LMIC's. This review provides a useful taxonomy of interventions to support this aim. We are building on this work at Imperial College London by using the Delphi method to reach a firmer consensus on what the categories should be.

One of the main categories identified in this review was behaviour change. Smartphones provide a great opportunity for both measuring behavioural outcomes as well as delivering interventions. The focus of the next part of the this chapter is to look at the potential of mobile communication technologies in changing health behaviours around smoking and obesity, two significant contributory factors to the growth in NCD's.

b. A review of the evidence for digital health interventions targeting smoking and weight loss/ physical activity

Introduction

Systematic reviews have demonstrated the useful role of behaviour change interventions delivered over technology platforms such as fixed line telephones and the internet (388-390). More recently interest has been directed at the potential role of mobile phones in influencing behaviour change (387). The growing market penetration and new communication properties of mobile phone and tablet devices provide new opportunities for innovative behaviour change interventions and evidence is beginning to emerge about their potential value. In this Chapter, I look at the role of such technologies in two specific areas (smoking cessation and weight loss/physical activity) to see what evidence exists worldwide for their use, with an interest in new smartphone based apps over and above widely evaluated SMS text messaging based interventions.

Existing reviews of mHealth interventions have tended to focus on different disease categories or behaviours (e.g. asthma or smoking) (391) or specific functions of mobile devices (e.g. SMS text messaging) (338). A systematic review has recently looked more generally at how digital health mHealth technologies have been used in behaviour change interventions, but it did not take significant account of software applications (apps) now running on smartphone devices (343). Smartphones mimic the functions of traditional desktop computers but with adaptions to mobile phone or tablets smaller screen. They provide 24/7 internet access and other functions such as video messaging, GPS location services and bluetooth connectivity to external hardware such as glucometers and blood pressure monitors.

This review looks specifically at how digital health or mHealth has been used to encourage smoking cessation and weight loss/physical activity. Both are important public health issues. Smoking

continues to contribute to a huge burden of disease globally and is the single most preventable cause of death worldwide (392). Cessation services have variable success rates with smokers who want to quit (393). Obesity increases the risk of developing chronic diseases including diabetes, stroke, cardiovascular diseases and osteoarthritis and has increased in almost all countries worldwide (394). Effective and scalable interventions have not been widely implemented in meeting the challenge of obesity and technology-based solutions offer significant potential as they can be used outside the healthcare setting as people go about their normal lives (395).

The review is divided into two parts. The first looks at the use of SMS text messaging which is the most universally accessible and popular technology for phone based health interventions. It is also the feature that has been most established in trials investigating behaviour change through mobile devices (343). The second part of the review investigates the role of new software applications that run over next generation smartphone devices. This is not a systematic review of the effectiveness of health interventions delivered through mobile devices, not least because progress in the field is so dramatic that no review can hope to remain a true marker of progress in the field and much of the progress is reported outside of peer-reviewed academic journals. Rather it acts as a focus for where the rapid progress seen in the field has got us to.

Objectives

To undertake a review of the evidence base for digital health interventions targeted at smoking and obesity/physical activity. The review is in two parts. Firstly looking at evidence os SMS based interventions. Secondly looking at app based interventions delivered over smartphone devices.

Methods

I adopted a structured approach to identify the available literature addressing the use of mobile delivered interventions in the fields of smoking and obesity/physical activity using both SMS based interventions and app based solutions.

DATABASE SEARCH

Eligible studies were retrieved from a search of the established research literature with findings supplemented with reports from 'grey' literature. An inclusive string of free terms was developed to query PubMed, EMBASE, PsychInfo, Google Scholar and the Cochrane Library for research reports published from July the 1st 2005 and August the 1st 2013. Search terms included mobile phone, cellphone, short messaging service (SMS), multimedia messaging service (MMS), mHealth, smartphone, app. As this review looked at certain specific behaviours we also included the following search terms as AND - smoking, smoking cessation, quit smoking, obese, obesity, overweight, weight loss, physical activity, exercise.

INCLUSION AND EXCLUSION CRITERIA

For the purposes of this review I was interested in any intervention delivered using mobile communication devices (SMS and app based interventions) targeted at smoking and weight loss/ physical activity. The search was limited to papers written or translated into English and only included studies with a randomised or quasi-experimental design. Studies incorporating email or other forms of communication intervention were only included if SMS or the use of software apps were the primary intervention. Based on the abstracts reviewed, studies were selected that delivered a behaviour change intervention via mobile phones and measured impact by assessing a change in behaviour or health/process outcomes. A broad range of study designs incorporating randomised controlled trials, cohort and case-control studies and descriptive case studies were included.

Previous reviews of the literature have not widely surveyed the many commercial health applications being delivered through mobile phones and studies published in the grey literature were also investigated. Grey literature is defined as 'that which is produced on all levels of government, academics, business, and industry in print and electronic formats but which is not controlled by commercial publishers' and sources of grey literature reviewed including proceedings from conferences, blogs, reports.

SCREENING PROCESS

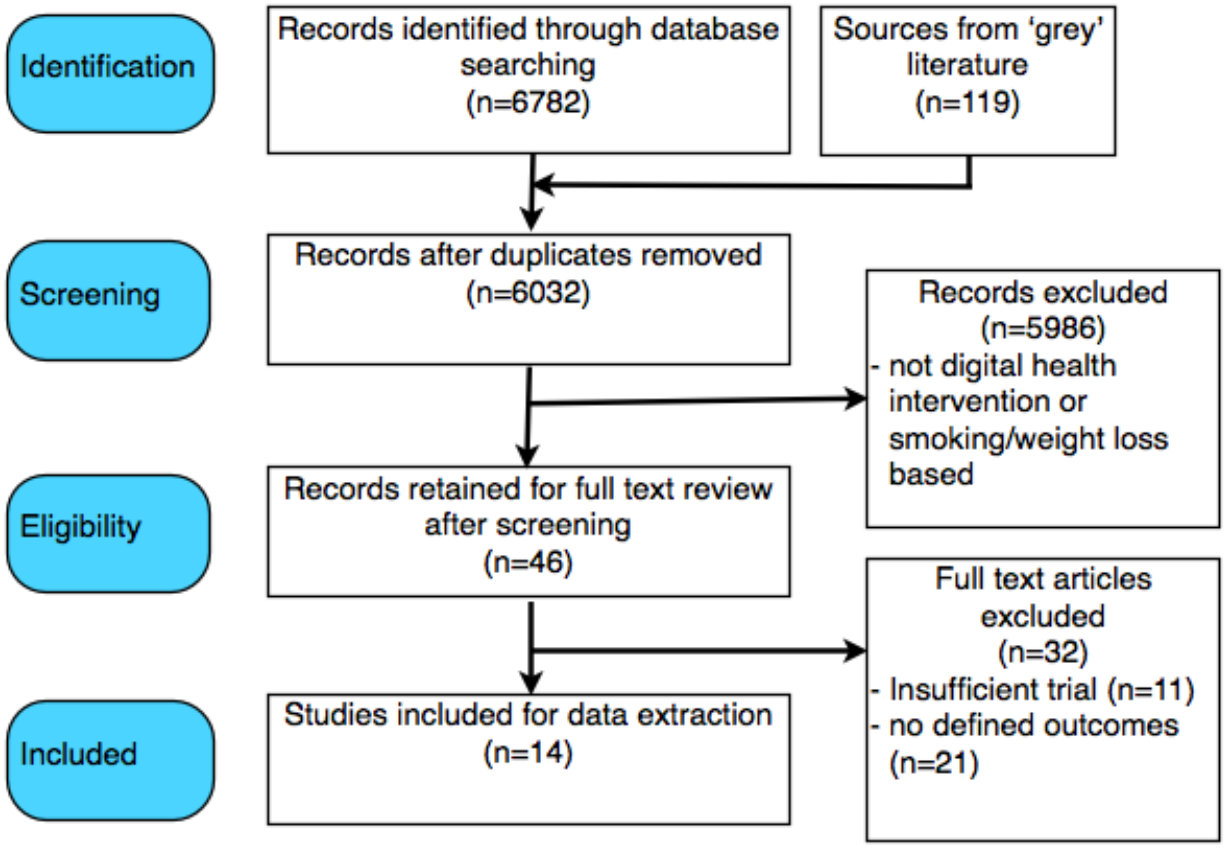
Two reviewers (DK and HL) identified and retrieved eligible studies. After initial screening, full text articles of potentially relevant studies and reports were retrieved and reviewed against the specific inclusion and exclusion criteria with disagreements resolved through discussion. For both peer-reviewed publications and the grey literature, references in articles were back searched and were reviewed for additional articles.

Results

DATABASE SEARCH RESULTS

The literature yielded 6,782 articles from peer reviewed journals and 119 web-based 'grey' literature links for review. In initial screening excluded 6,127 articles and 58 links. Further screening based on a more strictly defined set of inclusion and exclusion criteria excluded a further x articles. In total x articles met the inclusion criteria (see Figure 8.3). Articles were further subdivided into those using SMS based interventions (n=12) and those using app based interventions (n=2).

Figure 8.3: Database search results (as per Preferred reporting for systematic reviews and meta-analyses (PRISMA))



Short messaging services (SMS)

Short message service (SMS) is a text messaging platform that is widely used as a means of communication across different ages and socioeconomic groups (396). Text messaging may be one of the least advanced features of mobile phones but it remains the most widely available and adopted feature of mHealth (338). SMS enables 160 character messages (or more) to be sent across all the different types of handset devices and allows messages to be interchanged from one mobile phone or computer to one or many other mobile phones almost instantly and in almost any place or setting and at low cost. An unlimited number of recipients can be sent standardised, bulk messages (e.g. 'smokers have a 30% higher risk of stroke then non-smokers') or messages can be

personalised and tailored to the individual (e.g. ‘as a 40 year old male smoker, your risk of a heart attack in the next year is 25% higher than a non-smoker).

SMS usage is high across all socioeconomic groups with heavy use interestingly associated with more socioeconomically disadvantaged populations (397). People who are frequent users of SMS are also likely to report lower levels of self rated health (398) and engage in health-compromising behaviours (399) suggesting that interventions using SMS may be particularly worthwhile in reaching traditionally hard to reach groups. Multimedia Messaging Service (MMS) extends the capabilities of SMS by allowing users to include pictures, audio and videos as part of their messages.

To date, SMS-based interventions have primarily been used for simple information provision such as to deliver medical test results and to remind patients of scheduled appointments and medication timings (342, 400, 401). But there is increasing interest in delivering complex behaviour change interventions based on theoretical models and individualised feedback within SMS programmes (343). A previous Cochrane review published in 2012 has found limited evidence that SMS can support preventative health care and behavioural interventions (402), but it is a fast moving field so I look at progress in two specific fields: smoking cessation and weight loss/physical activity.

Smoking cessation

A Cochrane review in 2012 investigated mobile phone based interventions for smoking cessation and identified three studies that were purely based on text messaging (although one reported mainly qualitative findings). A meta-analysis of the identified studies did show that SMS based interventions were effective in facilitating quit attempts (391). A further Cochrane review investigating the role of text messaging in wider preventative health interventions identified only

one study suitable for analysis (402). This review identified total of 4 studies that used an RCT based approach with smoking cessation as one of the main outcome measures (see Figure 8.1).

SMS based interventions have been seen to have a promising impact impact on quit rates. A single-blind, randomised trial undertaken in the UK saw smokers willing to quit randomly allocated to different support groups. Biochemically verified abstinence at six months was significantly increased in group receiving motivational text messages and behaviour change support compared to text messages unrelated to quitting (10.7% in intervention group vs 4.9% control, relative risk 2.20, $p<0.0001$) (403). Daily, individually tailored SMS messages providing personalised smoking cessation advice also demonstrated a short term benefit in cessation rates but this was not sustained at 26 weeks (404).

Weight loss and encouraging physical activity

A number of trials that have investigated the use of SMS text messages in weight loss interventions but many have only looked at the feasibility (ability to transmit information to recipients) and acceptability (recipients comfort with receiving messages to their mobile phones) of SMS rather than more meaningful clinical trials (405-408). Studies investigating whether SMS can reduce calorie intake, increase physical activity or both (main outcomes related to either weight loss or increased physical activity) are described in Table 8.2.

There was a paucity of evidence on where SMS could support people in reducing calorie intake and where a study did measure intake, no significant change was seen when compared to the control group (409). There was more evidence in relation to how SMS could motivate physical activity and whilst SMS based physical activity interventions were often effective (410-412), a well designed study using a pedometer to collect information on daily steps showed no impact of motivational

messages in adolescents with diabetes (413). Whilst there is evidence that SMS delivered interventions can lead to significant weight loss compared to control groups (411, 412, 414) other studies have not demonstrated a significant impact (406, 413).

Figure 8.4: Trials of SMS in smoking cessation

Study	Design	Intervention	Participants	Primary outcome measure	Results	Comments
Rogers 2005(406)	RCT	Regular, personalised text messages providing cessation support and advice	1705 adult smokers	Smoking status	6 weeks cessation rate: 28% vs 13% control (p= <0.0001) had quit smoking in intervention group	
Haug 2013 (539)	RCT	Automated text messages tailored to demographic and smoking related variables	755 adolescent smokers	7 day smoking abstinence	7 day cessation rate: 12.5% vs 9.6% (control) (p=0.92)	
Free 2011 (405)	RCT	Automated motivational text messages and behavioural support	2500 adult smokers	Smoking status at 6 months (biochemically confirmed)	6 months cessation rate: 10.7% vs 4.9% (control) (p=<0.001)	
Ybarra 2012 (538)	RCT	Automated daily messages providing cessation support	200 adult smokers	Self reported abstinence at 3 months	3 months: 11% vs 5% (control) (p=0.24)	Study not powered adequately

Study	Design	Intervention	Participants	Primary outcome measure	Results	Comments
de Niet 2012(537)	RCT	Tailored feedback via SMS following weekly self monitoring data	141 overweight and obese children	Weight, eating behaviour and psychological well-being	SMS intervention did not improve weight loss	
Patrick 2009(416)	RCT	16 week programme of daily SMS and MMS messages	75 adult men	Weight loss	4 months: Intervention group lost more weight (-1.97kg, p=0.02) versus control	
Park 2012(536)	Quasi experimental RCT	SMS messages with supportive content on diet and exercise	67 adult women with abdominal obesity	Waist circumference (WC) and body weight (BW)	12 weeks: WC decreased by 3cm and BW by 2kg vs control as baseline	Concerns about randomisation process
Fjeldsoe 2010(412)	RCT	Two SMS messages per week with supportive content	88 postnatal adult women	Frequency and duration of exercise per week	13 weeks: increased frequency of exercise (1.82 days/ week p=0.038)	Self-reported measures Messages targeted constructs of social cognitive theory
Prestwich 2010 (414)	RCT	SMS messages with supportive content on diet and exercise	149 adults	Measure of physical activity (brisk walking)	4 weeks: 2 different intervention groups incorporating SMS both increased brisk walking relative to control ($p<0.05$)	Self reported
Hurling 2007 (413)	RCT	SMS delivered exercise support and reminders	77 adults	Self report and objective physical activity	9 weeks: Average increase in exertion was 2h18mins per week vs control	Used wrist based accelerometer

Study	Design	Intervention	Participants	Primary outcome measure	Results	Comments
Newton 2009 (415)	RCT	SMS delivered motivational messages	78 adolescents with diabetes	Daily step count measured through a pedometer	12 weeks: No significant difference between step count from baseline	Used pedometer
Haapala 2009 (411)	RCT	SMS messages with supportive content on diet and exercise	125 healthy but overweight 25-44 year olds	Weight loss, waist circumferen ce	12 months: significant wight loss vs control (6.3kg p= 0.001)	

Smartphone based software applications (apps)

Smartphones are feature rich mobile phone handsets capable of running special purpose third party applications (apps). Thousands of apps are targeted at different health behaviours and are available across the different software operating systems (e.g. Apple iOS and Google Android). Most apps will leverage one or more specific functions supported by smartphone devices such as inbuilt accelerometer sensors that can measure movement (e.g. Moves app - see figure 8.3). Almost all smartphones are able to network with external sensors and as a consequence have the potential to connect directly to glucose meters, portable electrocardiograms and digital scales (341). Importantly smartphones allow anytime connectivity to the internet anywhere where there is a network connection allowing information and data to be easily exchanged.

In comparison to SMS, apps allow users to track and share more complex information and data and provide the opportunity for ‘frequent and interactive feedback and immediate access to social support from peers and coaches’(395). In a recent review by Klasnja, examples of mobile-phone health interventions that took account of new generation smartphone devices were broken down by intervention strategies and the phone features they employed. These were 1) tracking health information, 2) involving the healthcare team, 3) leveraging social influence, 4) increasing the

accessibility of health information, and 5) utilising entertainment (341). Looking at smoking cessation and weight loss/physical activity in relation to smartphone apps allows us to see progress in the field and potential for the future

Figure 8.5: Screenshot of Moves app that measures physical activity



Smoking cessation

A number of smartphone apps available to support attempts at smoking cessation were identified and there is enthusiasm for their use particularly given smartphones ability to engage young people and minority groups (415). The National Health Service in England and Wales have released a free *NHS Quit Smoking* app which is available from the iTunes store. The app provides daily support and instant tips to smokers making quit attempts. There are dozens of other apps available through app stores, which include LIVESTRONG MyQuit coach, Quit It Like, Quit Smoking and Butt Out. These different apps take a number of approaches to facilitating quit attempts such as delivering motivational messages and/or providing a running tally of number of days quit for and total cost savings. There have been concerns that many of the smoking cessation apps available are not fit for purpose and certainly many fail to adhere to key evidence-based guidelines. The majority of the 47

apps evaluated as part of a content analysis of available smoking cessation apps were not evidence-based (416).

Despite the apparent popularity of smoking cessation apps, this review was unable to find one published trial of the effective use of an app in enhancing rates of cessation. There is an expectation that further research will follow and a protocol has been published for at least one randomised trial investigating the potential role of a cessation app in Spanish adolescents (417). One interesting finding from the review is that pro-smoking apps are also available in the different app stores. A review in 2012 found 107 such apps, many of which heavily featured cigarette branding (418).

Weight loss and activity

Hundreds of apps are also available to facilitate weight loss either through improvements to diets or by enhancing physical activity. Self monitoring of diet and physical activity are key components of behaviour change strategies in obesity. Smartphone apps are well suited to collecting this data and are being widely used to support logging of physical activity and/or food intake and produce charts that look at trends in the data over time. In measuring physical activity such platforms typically use a phones inbuilt accelerometers sensors or small wearable sensor devices (e.g Nike Fuelband) that can connect to the app over wifi. For recording dietary intake some apps provide a simple food diary whilst others allow users to photograph their meals or measure calorie counts through barcodes.

For measuring physical activity, a study looking at the use of different self monitoring tools (mobile app, website, or paper journal) found that app users self-monitored exercise more frequently over the 6-month study than non-app users and also had a significantly lower BMI at 6 months (31.5kg/m^2 vs 32.5kg/m^2, p=0.02). A PDA based self monitoring app which also provided daily tailored feedback resulted in a small weight loss at 24 months against a paper diary and no feedback mean

percentage weight loss -1.94% in paper diary group and -2.32% PDA with feedback, p=0.02). No significant weight loss was seen in a group just given the self monitoring PDA app without tailored feedback (419).

A number of interesting apps allows users to record information about their diet from barcodes or by taking pictures that can provide some indication of dietary and nutritional intake. The results of a food diary that allows users to take pictures of the meal they have just eaten was reported at a conference. The feasibility pilot of 12 obese participants found that after 4 weeks the average weight loss was 1.5kg per user (420).

Exergames is a term used to describe games or GPS based platforms that encourage people to increase their physical activity. Significant weight loss in adolescents has previously been seen with the use of games played using the Nintendo Wii platform (421). Different exergame platforms (e.g. Walk2Build and Phone Row) have been created for smartphones but no trial could be found exploring their use.

Similar concerns regarding the evidence-based used for most of the apps targeting obesity are shared with smoking cessation apps. In a 2009 study, 204 apps were identified from the iTunes store and measured against 13 evidence-informed practices for weight control. The majority of apps were found to have insufficient evidence-informed content (422). There is expect that studies will son be completed that add to the evidence base in this area. A team led by Pelligri have published a protocol for the ENGAGED study which is an innovative randomised controlled trial that will examine the feasibility and efficacy of a theory guided, technology supported weight loss programme delivered using a smartphone app. Users will be able to track dietary intake and weight and communicate with team members using direct messaging. The app is planned to connect to an accelerometer to provide real time information on physical activity (395).

Discussion

Mobile phones provide an attractive platform to encourage behaviour change given their wide adoption, portability and technical capabilities. In addition to helping to collect data on behavioural outcomes (e.g. activity levels or calorie counts) they can also be used to deliver motivational messages, support and information to the recipient. Whilst such functionality can theoretically be delivered through SMS, apps running on smartphones devices have expanded the utility of mobile phones for public health health interventions. The computational power of smartphones and associated networks can now handle complex aggregate providing salient information and useful support to the end user.

Improvements in interface design, batteries, processors and wireless technologies is enhancing the power, personalisation and mobility of handsets. We are now seeing smartphones as the hub of a body sensor network that sees wearable sensors on the body measuring health related parameters (e.g. blood pressure, blood glucose). It should only be a matter of time before integrated systems form the basis of very sophisticated behaviour change programmes where 'just in time' interventions are delivered when support is most needed to encourage healthy choices (423). So smokers may receive motivational messages at certain times of the week or in specific contexts when they are most likely to light a cigarette. Interventions delivered over mobile phones are easily scalable over large populations and can be individualised and tailored.

The use of mobile phones in promoting health behaviour change through SMS is promising even if there are limited randomised trials and those that are are limited by relatively small sample sizes (408). Because of the relative newness of smartphones and the apps that run on them, there is a paucity of data and long-term follow up but huge interest and enthusiasm about their use. It is clearly important that in this fast moving field that an evidence base to these interventions.

There are concerns about the quality of study designs in mHealth interventions with reported trials often failing to be adequately powered, having poor retention rated and not always using validated scales (408). A systematic review of 42 controlled trials investigating the role of mobile-technology based interventions designed to enhance health care delivery found that none of the trials were of high quality and many had significant methodological problems (340) There is also little attention paid to the cost effectiveness of mHealth interventions although an analysis by Joo did show that a community-based obesity control programme was more cost-effectively delivered remotely (by SMS and through the internet) rather than in person (424). In terms of improving the evidence base in regard to mHealth interventions, Shaw made the following recommendations in regard to SMS interventions in obesity, but they apply more widely (408):

1. large randomised controlled trials with a significant sample size that can be used to determine effect sizes and statistical significance;
2. intervention trials that are longitudinal in nature and evaluate maintenance of weight loss behaviours (12 months or longer);
3. specific evaluation of cost-effectiveness, frequency, timing and optimal use of SMS;
4. more detailed reporting of intervention content and outcomes with respect to the magnitude of between-group differences at follow-up, and the direction and magnitude of change between end-of-intervention and follow-up

Further studies and interventions should certainly describe the theoretical constructs being targeted as very few currently specify an underpinning theoretical construct (338). Very few apps are based on empirical evidence. Only seven of the reported 26 studies in a review of mHealth interventions for behaviour change or healthcare delivery reported using ‘specific behavioural theories to underpin their intervention’(343). This is particularly important given that interventions based on

behavioural theory are more likely to be successful (425). Behaviour change theories that have been incorporate into reported studies have included social cognitive theory (the most common), implementation theory and the trans-theoretical model (343). A good example of an robust approach to the development of an app is described by King who describes the design of an app to promote daily physical activity based on different motivational frames. Targeted users took part in the iterative design process and acceptability was also evaluated (426).

Mobile phones as a platform for behaviour change is not without challenges - access to handsets, good reception, cost appropriate interfaces are all important considerations in implementing public health interventions through this medium. Technologies intended for health related functions should be able to be easily used by the target population, which may include the very elderly, illiterate and disabled. Most smartphone devices provide intuitive operating systems but handsets like the Jitterbug phone are produced that meet the needs of those with reduced vision or dexterity (427). There are also some concerns about the reliability of what are in effect medical devices but at present fall through the cracks of regulation. Incorrect use of measurement or sensing devices or incorrect collaboration of physiological data could lead to significant errors and adverse events (341).

Initial studies have demonstrated the potential for delivering health behaviour change over smartphones but there is much to be learned about how such interventions can best work. There is no doubt that mHealth is here to stay and that smartphones and similar devices offer tremendous opportunities to improve the health and well-being of populations. Well designed trials will support wider implementation and appropriate support from governments and health providers.

Conclusions to chapter

Digital health (particularly as applied to behaviour change) was a concept that was hardly discussed at the commencement of my thesis but by its close there was huge interest and developments in the

field. There is good reason to be excited about the potential role of mHealth and in the early part of the chapter I define the different areas where advances are being made. With almost as many mobile phone subscriptions as people on the planet, the ubiquity of mobile technologies offers huge opportunities as a platform for delivering (behaviour change) interventions and making healthcare more accessible, faster, better and cheaper. Kathleen Sebelius the US Health and Human Services Secretary stated that mHealth is 'the biggest technology breakthrough of our time (being used) to address our greatest national challenges'(428). But while there is significant interest in leveraging mobile technologies to change behaviour there is a lack of high quality evidence to support its wider implementation. By looking at how mobile phones have been used to target smoking and obesity/activity, it is clear that there is a paucity of peer reviewed publications evaluating the impact of mHealth based interventions despite the huge number of apps available.

The key to maximising mobile platforms for effective behaviour change in the future will be the rigorous application of research driven development and evaluation to areas of real need. While there is huge interest in developing mHealth solutions to enhance health outcomes and service delivery this has arguably led to an 'enthusiastic proliferation of untested methods' (429). Although innovation should be encouraged, an evidence base needs to be developed to make this field credible. Whilst there is a growing body of evidence supporting the use of mobile phones in health interventions, there are specific concerns that many available apps are not effective or engaging and do not meet the needs of the end-user (430). More attention needs to be paid to structuring app development in theory or best practice (431).

Further to this initial scoping work I have subsequently led successful grant applications to develop and implement a range of mHealth applications targeting the behaviour of both providers and patients and the public. Our group are targeting interventions at the problem of clinic non-attendance (with differently worded SMS text messages inspired by Mindspace), a commitment

based programme delivered over mobile phones to encourage weight loss in obese children and a reminder service to enhance medication adherence.

In parallel to the growth of mobile communication technologies, the last few years has also seen the proliferation of social media (like Twitter and Facebook) that allow people to interact and share information in virtual communities. The focus of the next chapter is on how the user generated content from these communities can be used for social science and policy research.

9. Measuring the impact of 'messenger' effect in social media

Summary

Social media (for example Facebook and YouTube) uses online and mobile technologies to allow individuals to participate in, comment on and create user-generated content. Twitter is a widely used social media platform that lets users post short publicly available text-based messages called Tweets that other users can respond to. Twitter enables its members to post text-based messages of up to 140 characters about any topic. The short format of the message – or Tweet – is the defining characteristic of the service. Twitter can be used to extract information about products or brands, provide insights about public opinions and predict and track events or issues of importance. As Twitter has entered mainstream use, the hashtag appears to have come of age politically. Regime changes in Egypt and Libya have been labelled 'Twitter revolutions', whilst the re-election of Barack Obama in 2012 was termed the first 'Twitter election'. Whilst these terms may overstate the actual role of Twitter, it hints at Twitter's soaring popularity and potential importance. In parallel with the popularity of Twitter, there has been a growing interest from social science researchers in analysing the content of social networks.

In a healthcare context, Twitter is being used by clinicians, patients, hospitals, policymakers and industry for a range of purposes. Doctors are joining Twitter journal clubs and holding Q&A sessions with patient groups. Hospitals and politicians are Tweeting about public health emergencies and how the public should better access. The impact of all the health related information signposting and debate that is taking place on Twitter is hard to quantify, but some messages and messengers (Tweeters) appear to be having a substantial influence.

In this Chapter, I specifically look at how we could reliably measure 'messenger' impact on Twitter. Messenger effect is the first element of Mindspace and its potential importance is described more

fully in earlier chapters but relates in essence to weight given to information based on who communicates that information, rather than just on the specific content itself (57). In terms of behaviour change, an influential, trusted messenger can matter as much or even more than the message with 'influentials' catalysing the diffusion of opinions, behaviours and products through social networks (58).

I explore the different methods currently being used to measure messenger influence in social networks and present a novel way of measuring context dependent influence on Twitter based on the academic H-index. The H-index (named after its inventor the physicist Jorge Hirsch) was designed to improve on traditional metrics for academics such as total number of publications or the total number of citations by measuring simultaneously the quality and quantity of scientific output. I begin by looking at how the T-index (the modified version of the H-index applied to Twitter) can be used to measure messenger influence in 4 broad areas. I then look in more depth at how Twitter was used in discussions about the controversial and radical reforms to the National Health Service (NHS) in England that were passed into law in 2012. By collecting and analysing over 120,000 Tweets made about the health reforms, insights were obtained for the first time about the role of Twitter in informing, debating and influencing opinion in a specific area of health policy. I finish by measuring messenger influence across the Tweets made to elicit a table of the most influential Tweeter on health policy in the NHS.

a. Measuring influence on Twitter

Introduction

Online social networks have become popular platforms for online communication for a worldwide audience. Twitter is a widely used social networking and microblogging platform that allows users to post short text-based messages called Tweets that other users can respond to. The short format of the Tweet (up to 140 characters) is the defining characteristic of a service that is now the worlds eleventh most popular website (alexa.com/topsites, accessed 13th of August 2013). Tweets can range from a users personal status updates to breaking stories from the major news networks.

The relationship between two users on Twitter is through *following* where a user actively choosing to follow another user. By default, all posted messages on Twitter are publicly available. Relationships on Twitter are not necessarily reciprocal - one user can follow another without necessarily being followed back. A user can follow friends and family or may choose to follow celebrities, companies or news organisations. Tweets made can be rapidly disseminated through different networks by retweets where someone chooses to repeat a Tweet by someone they follow so that information spreads outside of the original Tweet's reach. With millions of Tweets every hour, the hashtag (represented with a hash symbol #) is used by by Twitter users as a a metadata tag that provides a means of grouping messages together. The hashtag categorisation can be used to search for certain topics and get the set of messages related to it or to follow a conversation or event.

With its ability to monitor a constant stream of communication, there is a growing interest in analysing the content of Tweets by the social sciences research community (432). Research on online social networks has focused on Twitter rather than other networks due to wide global reach and popularity and because Tweets are public and downloadable from the Twitter server using automatic tools. Twitter can be used to extract information about products or brands, provide

insights about public opinions and predict and track events or issues of importance (433). Analysis of Twitter data sets has demonstrated that estimated levels of influenza-like illness derived from Twitter chatter can accurately track reported disease levels (434), that the mood on Twitter can successfully predict with an accuracy of 86.7% the closing prices on the US stock market (435) and that earthquakes in Japan can be predicted with 96% sensitivity by monitoring feeds (436).

Given Twitter is expressly devoted to exchanging and disseminating information it acts as a natural laboratory for the study of messenger/social influence and finding out 'who listens to whom' (437). Who is influential on Twitter is important to a range of organisations as the platform is widely used as a marketing platform and a focus for discussing major events and trends. A clothing brand may seek out which Tweeters have most influence about their products, whilst someone looking for a restaurant recommendation may want to know which critics opinion is rated highest.

For issues in health policy it may be of interest to who is having influence about specific issues such as vaccinations and smoking and alcohol use. Currently many people simply look at the number of followers a Twitter user has but as we discuss later the number of followers does not accurately capture the notion of influence. A number of commercial companies have sprung up that claim to provide robust measures of influences on Twitter but provide little transparency as to how their metrics are calculated. An alternative approach to measuring influence on Twitter is proposed in this chapter. The T-index is a modified version of the H-index (or Hirsch Index), a widely used metric of the academic productivity.

The rest of this first section of the chapter is categorised as follows. Section 2 describes the different ways of measuring influence on Twitter. Section 3 introduces the H-index and the potential role of the variant T-index in measuring influence on Twitter. Section 4 describes how we collected and evaluated Twitter data sets using the T-index and section 5 and 6 what it all means. The second

section of this chapter then looks specifically at how these insights can be applied to a specific area of health policy.

Different ways of computing messenger influence on Twitter

A number of different strategies have addressed the question of how to measure influence on Twitter. Suggestions have come from both empirical academic research as well as commercial companies (e.g. Klout, PeerIndex) who derive value in providing information about influence on Twitter. Clearly to have influence on Twitter the user must have an audience (usually measured by the number of followers) but the information tweeted must also resonate with other users (measured in Twitter speak through retweets, replies, or mentions). I now describe in further detail some of the approaches for measuring influence on Twitter.

Follower Count (in-degree influence)

The number of followers a person has on Twitter (also known as degree influence) is in the simplest indicator of influence to measure and gives a rapid view of the size of the audience a user has. The follower count is used by Twitter and a number third part services to measure impact with the underlying assumption being that every Tweet published is read by all that users followers. Some Twitter users may have tens of millions of followers (see Figure 9.1 for the most popular Twitter users worldwide) but the sum total of followers actually provides little genuine demonstration of how influential a user is and it is certainly not a comprehensive measure (438). This is particularly true given the emergence of ‘fan-buying’ companies (e.g. BuyTwitterFollow.com), spammers and automatic programs called bots that automatically follow users and artificially inflate follower numbers.

Figure 9.1: Highest number of followers on Twitter (accessed on 14th of August

Account	User	Number of followers
@justinbieber	Justin Bieber Recording artist	43,038,680
@katperry	Katy Perry Recording artist	40,749,820
@ladygaga	Lady Gaga Recording artist	39,768,266
@barackobama	Barack Obama President of the United States of America	35,155,014
@taylorswift13	Taylor Swift Recording artist	32,302,832

Reply influence

Any Tweet can be responded to by another user with the more replies a user receives suggesting the more influential he or she is. Reply influence can be quantified either as the total number of replies the user or the number of users who make the replies. A previous analysis has shown reply influence to be a useful metric in evaluating how far and how fast a message can be propagated through different networks (439), however replies are less common than other strategies such as retweeting in disseminating information through Twitter.

Retweets

Retweeting is the key mechanism for information diffusion in Twitter and provides the potential for an important message across the network of Twitter users in minutes. Twitter users can pass on information they feel is important to propagate through retweets and the more frequently the user's messages are retweeted, the more influential the user is presumed to be. Similarly to reply influence, this can also be quantified as the total number of retweets or the number of users who retweet. Retweets represent the content value of a user's Tweets and is a measure of influence

outside of individual users one to one interaction (440). Retweets are used as a core metric for almost all providers of composite measure of influence on Twitter.

Commercial influence score providers

Social media companies such as PeerIndex and Klout claim to accurately measure influence on Twitter. Such companies extract and organise collected Tweets and apply propriety algorithms to the data. They then typically provide a score of the users influence out of 10 or 100, which is a composite measure of different variables such as the number of followers and frequency of retweets. Companies providing such services tend not to share information in detail as to how they arrive at their score. Usually the influence rankings provided by companies are domain independent and do not measure a users specific impact on a given topic areas.

Open source measures

Several academic groups have proposed more transparent measures of influence on Twitter. PageRank measures influence with only a link structure of the network taken into account and has been used in other domains outside of its role in measuring influence on Twitter (438). TwitterRank estimates influence by taking both the topical similarity between users and link structures into account (441).

The H-index and its potential use in measuring impact on Twitter

Scientists and research organisations use a range of different metrics to measure the impact of their research with citations in peer-reviewed articles being the primary measure. The H-index (named after its inventor the physicist Jorge Hirsch) was designed to improve on traditional metrics for academics such as total number of publications or the total number of citations by measuring simultaneously the quality and quantity of scientific output (442). Hirsch argued that the measure was preferable to other single-number criteria being used and defined the H-index as follows:

The value of H is the number of papers that have each been cited by at least H other papers. So a scientist with an H-index of 15 has at least 15 papers that have been cited at least 15 times each.

Issues with more traditional measures of academic impact are that the total number of academic papers published said nothing about the quality of these publications, whilst the number of citations can be disproportionately influenced by publishing one highly cited and influential paper. Some of these same issues are relevant for widely used measures of influence on Twitter with publication number being analogous to the number of Twitter followers (quantity) a user has and citations with the number of retweets a user generates (quality). The principles underpinning the H-index can also be translated to Twitter and have proposed the metric T-index along these lines. The T-index is defined as follows:

The value of T is the number of unique tweets that have at least t other retweets about a specific subject. So a Twitter user with a T-index of 20 has 20 unique Tweets that have been retweeted 20 times about any specific topic.

T-index is primarily used to measure influence in relation to specific topics. This is in contrast to most existing measures of influence on Twitter that tend to measure overall impact of individual users. By concentrating on specific domains, T-index better reflects how we tend to evaluate influence in the offline world. Such an approach is facilitated by the grouping of Tweets about specific topics through widely used hashtags. The T-index can also be calculated for any term or username, for example to find out who are the most influential Tweeters about @barackobama or indeed what @barackobama's individual T-index is. As long as the data is available, the T-index for any topic can be calculated for specific time periods and could even be localised to specific demographic and geographic groups.

Calculating the T-index for specific topics on Twitter

In this analysis I prospectively obtained a collection of public tweets that were recorded from an Application Programming Interface (sometimes known as the Twitter 'firehose') that Twitter makes freely available. I collected data on four topics (Manchester United, David Cameron, Glastonbury Festival and World War Z) from November the 15th 2012 to August the 15th 2013. Descriptions of each of the different topics we collected Tweets on can be seen in Figure 9.2 alongside the total number of Tweets about each topic collected over the period of data collection.

The approach taken was to collect all tweets in real-time related to the four specific topics. The most appropriate hashtag for each topic was determined and where relevant closely related terms were also included. By focusing primarily on hashtags and restricting our search terms, Tweets may have been missed about topics we were seeking to evaluate, however we can be confident that the tweets analysed are specific to the issue - if not a complete set There were occasional outages in data collection due to sporadic problems in our Tweet aggregation server, e.g. disruption of API stream and power outages.

The Twitter users with the highest T-index for each of the four topic areas seen in Figure 9.3. This approach demonstrates that the most influential voices over the medium include a mixture of established figures, traditional media outlets and people who ave risen to prominence primarily through the medium of Twitter.. In Table 8.4 we compare the users with the highest T-index ratings in relation to other alternative measures of impact for David Cameron.

Figure 9.2: Topic areas and total number of Tweets

Topic area and related hashtags	Description	Number of Tweets collected
Manchester United #manchesterunited #mufc	Manchester United is a professional English soccer club that is one of the most widely supported football clubs in the World	5,473,732
David Cameron #davidcameron	David Cameron is the UK Prime Minister and leader of the Conservative Party. He came to power in May 2010	440,711
World War Z #worldwarz	World War Z is a apocalyptic film starring Brad Pitt that premiered to much hype in June 2013	152,387
Glastonbury Festival #glastonbury	Glastonbury is one of the worlds leading music festivals that is attended by nearly 200,000 people annually. In 2013 it was held over the last weekend of June	353,163

Figure 9.3: T-index ranks for five topics collected

Ranking	Manchester United	David Cameron	World War Z	Glastonbury
1	indomanutd	marcuschown	WorldWarZMovie	NME
2	OneLoveTo_MU	BBCBreaking	ParamountUK	RollingStones
3	premierleague	BBCNews	ParamountPicsIN	Fuckingledge
4	ManU_FC	chunkymark	totalfilm	SmiffysUK
5	MUFCSupport	guardian	UIPIndonesia	BBCNews
6	MUFCBulletin	DailyMirror	ParamountAU	BeautyByGeeks
7	ManchesterItds	DrEoinCl	YahooMovies	MooseAllain
8	unitedarmyfc	THemingford	paramountfr	ArcadeFiretube
9	ManUtd_Es	labourpress	ParamountIRL	Policeatglasto
10	BBCSport	TelegraphNews	ETonlineAlert	RudimentalUk

Figure 9.4: Comparison of different metrics for David Cameron

Username	T-index	Number of tweets	Number of followers	Klout Score
marcuschown	41	52,653	17,052	64
BBCBreaking	32	15,826	7,776,065	81
BBCNews	27	197,190	2,115,973	82
chunkymark	25	82,425	25,503	64
guardian	23	39,552	1,597,522	99

Discussion

For the moment at least, Twitter is an important platform in which information is disseminated and views exchanged across the world. Twitter and other social media platforms have already shown considerable impact on society as evidenced by there use during global events such as the 'Arab Spring' and the earthquake in Haiti (438). As more and more communication takes place online rather than offline, we need to better understand how information is exchanged. Central to this is the notion of influence and how to identify the 'messengers' with the greatest impact..

Information can be disseminated on Twitter through *mentions, replies* and *retweets* with Twitter feeds providing a 'realtime' reflection on the interests of users. There is a lack of clear consensus on which measure best reflects the messenger impact of Tweeters. Certainly, there is poor correlation between the different measures of Twitter influence (e.g. total number of followers and retweets) (438, 440, 441). The lack of transparency from commercial providers of composite measures of influence limits their usefulness for comparison.

The T-index provides a transparent and robust measure of influence on Twitter based on a widely used algorithm defining the scientific productivity and impact of academic researchers. The T-index has particular benefits to its use in measuring Twitter impact as like its academic counterpart it

measures both quantity (number of tweets) and quality (number of retweets or citations). Total numbers of Tweets much like total numbers of academic papers do not account for quality. In addition to the T-index being open and relatively easy to understand and calculate, it also measures domain specific influence rather than a users generic impact. Whilst users can hold influence over multiple topics (440), in many circumstances it is more beneficial to know who is influential in specific areas (e.g. about the Prime Minister or a film or music event).

Some concerns that exist with the use of the H-index also follow across to the T-index. Hirsch himself said that 'obviously a single number can never give more that a rough approximation' of influence. Some important criticisms of the H-index (which may also apply to the T-index) is that it does not value the importance of single contributions and it may be influenced by self-citations (443). Some other criticisms of the H-Index are not so pertinent for the T-index. The H-index favours multiple academic authors and discards informations about author placement. T-index on the other hand refers only to the originating author (or group). I now turn to the second section of this chapter an analysis of the role of Twitter in debating a specific area of health policy - namely the recent controversial 2012 NHS health reforms.

b. An analysis of the use of Twitter in discussing and debating the 2012 NHS reforms

Introduction

Twitter became a popular platform for scrutiny of the UK coalition Government's reform of the English National Health Service (NHS) (444). The Health and Social Care Bill was introduced in January 2011 and finally became law in March 2012, after more than a year of turbulent debate and hundreds of amendments. The radical structural organisation saw primary care trusts and strategic health authorities abolished and the handing over of commissioning (strategic healthcare purchasing) to new Clinical Commission Groups (445). Thousands of individuals and groups took to Twitter to discuss the reforms with contributions coming from mainstream media outlets including the BBC and The Guardian newspaper (e.g. @bbchealth, @guardian), organisations including the Department of Health and British Medical Association (@DHgovuk, @TheBMA), independent commentators (@Paul_Corrigan, @bengoldacre) and the general public. Examples of some tweets and their context can be seen in Figure 9.5.

As someone following the health reforms debate (and an active Twitter user), I became interested in how much of the important discussions about the Health Bill were taking place on Twitter rather than through traditional media channels. But, with tens of thousands of tweets from thousands of users it was difficult to determine what messages and which Tweeters (messengers) were having an impact. Despite a growing level of interest in analysing the content of tweets (433), to the best of our knowledge at the time of doing this work, there had been no previously reported analysis of how Twitter has been used to inform and debate a specific area of health policy. By prospectively collecting over 120,000 tweets about the reforms over a 45-week period, insights could be made into the role of Twitter as a platform to discuss and debate health policy. My particular interest in was measuring which Tweeters were having the the biggest influence as it appeared that some users

were having more of an impact than established figures who ordinarily would have been thought to be driving opinion.

Figure 9.5: Examples of tweets and their context

Sometimes tweets were used to reinforce opinion against the bill, and to signpost to other sources of information:

- Please read and RT this: what Lansley's proposing RT @mellojonny: The NHS needs reform, but not this #nhsreform: http://bit.ly/jS4aJf
- RT @estheraddley: Bit of a shocker Cam RT @bengoldacre: Cameron says RCGP, RCP and RCN support his NHS reforms. Here are their responses ...

Sometimes tweets were used to react to breaking news:

- Aha, here we go. RT @guardiannews Nick Clegg threatens to veto NHS reforms http://gu.com/p/2pv9k/tf
- Wow. PM's #nhs noises appear to hv calmed even BMA; RT @TheBMA: BMA comment on Prime Minister's speech on #nhsreforms: http://bit.ly/jVqJpl

Other Tweet conversations demonstrate how discussions and debate can build, with interaction between different groups and hierarchies . In the example, Clare Gerada (President of the Royal College of General Practitioners appears to respond to a Tweet from a Pete Deveson, a GP in Surrey.

- **Pete Deveson:**

@coxar @mellojonny @clarercgp @MBirty @HSJEditor NHS = free at the point of use. Reforms = the end of this. Breathless? http://t.co/LtyOhfF9 - 2012-01-26 17:14:24 -

- **Clarercgp**

@coxar @PeteDeveson @mellojonny @MBirty @HSJEditor Explain how the #HealthBill prevents co-payments, top-up fees? - 2012-01-27 11:01:04

Methods

Public tweets about the reforms were prospectively recorded from the 29th of March 2011 to the 22nd of February 2012. 120,180 tweets posted by 37,065 unique users were collected from Twitter's publicly available data (Twitter 'firehose') using Twitter's Streaming Application Programming Interface (API). This approach allows the collection of a real-time sample all tweets that included a set of keywords. There were occasional outages in data collection (amounting to 13 days in total) due to sporadic problems in our tweet aggregation server, e.g. disruption of API stream and power outages. Tweets were collected that contained the words '*nhs' and 'reform(s)*', appearing in any order and not necessarily adjacent. The filtering was not case-sensitive and our filter included tweets with the #NHSreform hashtag. This approach has flaws. By restricting our search terms, we might have missed many tweets on the topic. A broader strategy, such as looking at all tweets containing *NHS* would have been more comprehensive, but would have captured other unrelated issues too. By using this search strategy, we can be confident that the tweets analysed are specific to the issue - if not a complete set.

Two reviewers independently looked at 600 of the tweets collected (200 randomly selected tweets at three different timepoints) containing *'nhs'* and *'reform(s)'* and found that all of them were related to the health reforms proposed for the NHS in England.

Results

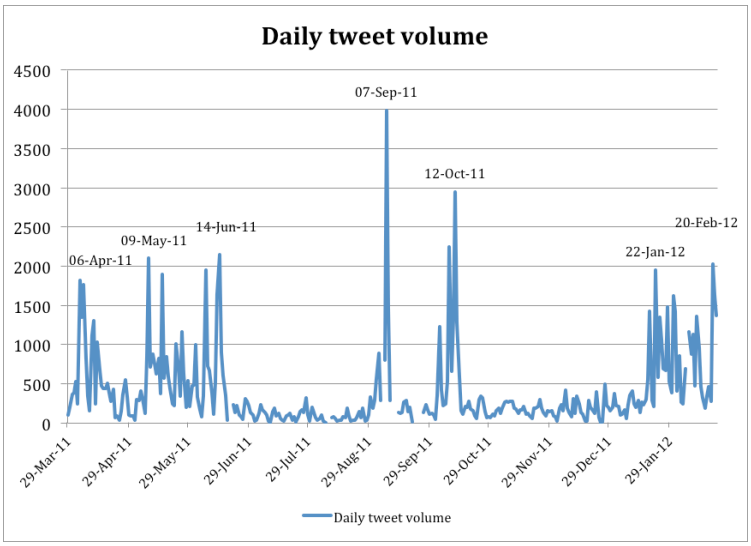
Tweeting Trends Over Time

The Health and Social Care Bill was introduced in the House of Commons on the 19th of January 2011. Initially there was little interest from the public and other bodies in the proposed reforms, perhaps through a lack of knowledge about how significant their impact would be. We started collecting tweets about the reforms on the 31st of March 2011 when the Bill had just passed through the committee stage of the Commons and when it was clear that the Bill would attract significant

controversy. In the following month, the Royal College of Nursing took the unprecedented decision to give the then Health Secretary Andrew Lansley, a vote of no confidence. Amid growing opposition, the Prime Minister David Cameron decided to pause the parliamentary process and announced the NHS Future Forum to oversee an NHS 'listening exercise' – a period when the Government claimed it would gain views from interested parties and make amendments to the Bill accordingly.

The frequency of tweets about the reforms varied with the Bill's passage through Parliament. Time series analysis is useful to look at phenomena that change over time, with simple online analyses tending to aggregate data into days to produce daily time series (446). The median number of tweets per day was 219 (range 8 to 3989). There were clear spikes of activity (Figure 9.6), that corresponded with crucial points in the passage of the Bill (Figure 9.7). It was not possible to say if spikes of activity on Twitter led the direction of debate but we can certainly say that Twitter activity responds and reacts to events rapidly.

Figure 9.6: Tweet activity and key events in the passage of the Bill through Parliament



Note: gaps in the line graph indicate times when no data was collected (due to outages)

Figure 9.7: Key dates in the Health Bills passage through Parliament

12th July 2010 – The Government release the 'Equity and Excellence: Liberating the NHS' white paper on NHS reforms which sets out its long-term vision for the future of the NHS

19th January 2011 – The Health and Social Care Bill is introduced to the House of Commons

31st March 2011 – The Bill goes through the committee stage of the House of Commons

6th April 2011 – David Cameron leads a discussion on the proposed NHS reforms at a Surrey Hospital where he says the Government would 'pause and listen, to reflect and to improve our NHS modernisation plans'

9th May 2011 – Members of Parliament debate the NHS reforms in the House of Commons. Nick Clegg threatens to derail the government's proposed Health Bill if 'substantial, significant changes to the legislation' are not seen

14th June 2011 – Major alterations of the Government's NHS reforms are published following a review from the NHS Future Forum found 'deep-seated concerns' about the plans

7th September 2011 – Despite threats of a rebellion, the coalition Government's controversial reforms of the NHS clears the House of Commons with a majority of 65

13th October 2011 – The House of Lords passes the coalition Government's Health and Social Care Bill at it's second reading

22nd January 2012 – The House of Commons Health Committee criticise the NHS reforms

20th February 2012 – David Cameron convenes a 'health summit' to discuss implementation of the Health Bill

27th March 2012 – Announcement in the House of Lords that the Queen had given assent to the Health Bill, making it an Act

* data collection began on the 29th March 2011 and finished on the 22nd of February 2012

Measuring messenger impact

As discussed in the earlier section of this chapter, there are a number of ways of measuring influence on Twitter (see Figure 9.9 for a specific example of the challenge of measuring influence in the context of the health reforms). By focusing on a Twitter users impact on a specific topic, the T-index provides us with an idea about how to find which messenger was having an impact in the NHS reforms debate.

Figure 9.10 shows some of the most influential Tweeters discussing the health reforms using the T-index metric. Alternative measures of influence are included for comparison. It should be noted that this rank of influence relates solely to the Tweets analysed rather than to the total output of the author across different domains. A specific issue of interest in relation to the T-index is that an author's domain specific influence may well be related to their popularity (number of followers) outside of the domain. The most retweeted individual Tweet having the #nhsreforms hashtag came from the British celebrity Russell Brand who has over 6 million followers on Twitter (See Fig 9.9). However this was his only Tweet about the reforms.

Figure 9.8: The challenge of measuring who has influence on Twitter

'Help breast cancer research! Take action to ensure research isn't left behind with #nhsreform' has been the most retweeted tweet about the health reforms. This may be a function of its author @rustyrockets who in real life is the celebrity Russell Brand. But a simple measure of influence such as the number of retweets achieved by a user says nothing about the number of different ideas put forward by that user (in @rustyrockets case, just this one).

In contrast, the number of tweets only indicates how much information a user is producing but it does not say if that information is being spread through the network. So Ben Goldacre, a medical doctor and influential science writer is only the 363rd most frequent twitterer on the health reforms, but his tweets are retweeted more than any other tweeter. The T-index combines these two ideas. It gives an indication of how many different ideas are reaching an audience. Furthermore, contrary to the Klout score, the T-index can be calculated using only a subset of a user's information according to any given criteria.

The T-index approach demonstrates that the most influential voices over the Twitter included a mixture of established mainstream commentators (such as Alastair McLellan the Editor of the Health Service Journal), traditional media outlets (such as the Guardian) and activists (such as Jonathon Tomlinson and Clive Peedell). The ability of the activists to perform so well – who might previously have found it hard to attract mainstream media attention – may demonstrate the ability of Twitter to remove hierarchies and promote grassroots voices.

Figure 9.9: The most influential Tweeters debating the 2012 NHS Reforms

Screen name	Individual/Organisation	T-index	Retweet ranking	'Tweeting' ranking	Klout score
bengoldacre	Ben Goldacre (journalist)	23	1	363	74
mellojonny	Jonathon Tomlinson (GP)	18	2	1	56
guardian	The Guardian (Media outlet)	18	5	94	85
RichardJMurphy	Richard Murphy (Economist)	17	6	107	57
HSJEditor	Alastair McLellan (Journalist)	16	3	2	59
cpeedell	Clive Peedell (Oncologist)	15	4	4	60
GdnPolitics	Guardian politics (Media outlet)	15	8	39	59
SaveTheNHS	Save The NHS (Campaign group)	14	12	73	46
clarercgp	Clare Gerada (GP and President of the Royal College of GP's)	13	7	21	63
guardiannews	Guardian news (Media outlet)	13	10	383	70
HackneyAbbott	Diane Abbott (MP)	11	18	1428	65
DrEvanHarris	Dr Evan Harris (Politician)	11	17	614	58
FalseEcon	False Economy (Campaign group)	11	15	252	50
SocietyGuardian	Society Guardian (Media outlet)	11	11	25	56
TheKingsFund	The King's Fund (Think tank)	10	16	66	52
tweetminster	Tweetminster (News agency)	10	47	1317	56
channel4news	Channel 4 News (Media outlet)	10	22	710	63
TheBMA	The BMA (Trade union)	9	28	111	51

Screen name	Individual/Organisation	T-index	Retweet ranking	'Tweeting' ranking	Klout score
Rethink	Rethink Mental Illness (Campaign group)	9	24	91	53

Discussion

Twitter is an emergent part of the health policy landscape. Major issues of health policy and wider public policy are now widely discussed on Twitter and its popularity as a platform for debate now exceeds its position at the time of this study. In 2014, when we looked to do a similar study about the American healthcare reforms (known as Obamacare or the Affordable Care Act) where we found over 60 million Tweets over a similar length of time.

However the influence of Twitter is not yet clear and it remains to be seen how effective it is as a shaper of national debate when compared to traditional platforms such as journals, newspapers or the broadcast media. From this work it appears that Twitter is timely, and a good source of breaking news although certainly in this study it tended to follow and comment on the debate, rather than lead it. It allows conversations across barriers of hierarchy and profession. It may have fostered discussion and collaboration between groups that rarely talk - not least health professionals and policy makers. It has given a strong voice to activists and frontline workers.

At the outset of this work there was a number of methods in popular use of measuring messenger influence on Twitter including number of followers, number of times their messages are retweeted, and the lifespan of the Tweet. Companies such as Klout and PeerIndex were using influence rankings but these tended to be domain independent and did not measure a user's impact on a given topic. The primary focus of this research was to establish a more robust mechanism for measuring the impact of different people using Twitter to discuss and debate the same health related topic.

Why is this important? By 2014, hospitals, clinicians and policymakers were using Twitter as a primary tool for disseminating information across patient groups and the general public. Whether the message is ‘please avoid attending the emergency department if you are not acutely unwell’ or ‘please make sure your children’s vaccinations are up to date’, it is important to recognise that the response may be a consequence of who is delivering the message in the first place.

It seems likely that social media and user-generated content are phenomena that will last, even if the specific platforms used change over time. For the moment, Twitter is becoming an important forum for discussion in many spheres of public life. The impact of the messenger rather than the message in social media is an important one. It could be that in certain circumstances, unexpected figures like celebrities may have more of an impact on issues of health policy or public health than established figures of authority (e.g. the Chief Medical Officer or Presidents of the Royal Colleges). The T-index can help us identify whose messages are resonating so that we can determine who is best placed to deliver important health related messages.

There is still much we do not know about how information and influence spread through online social networks like Twitter and there is great potential for further research. Twitter is well suited to studying influence because the diffusion of ideas can be tagged and observed, allowing us to determine how effective different ‘messengers’ of information are (59, 447). Future work may explore how knowledge is exchanged within networks (448), and how data can be aggregated to detect disease and health service performance (449).

The T-index described in this chapter has garnered significant interest and is being used to categorise messenger influence in a range of domains - see www.t-index.com.

Chapter 10

10. Applying behavioural insights in public policy: issues and considerations

Summary

The use of nudge or Mindspace type policies requires careful handling as there are important issues to consider with using 'behavioural' approaches. A key question is when is it - and when is it not - appropriate for government and other public organisations to influence citizens in certain ways. While policy makers are in the business of influencing behaviour, the application of new behavioural insights and modes of behaviour change to health and wider public policy has the potential for controversy. Behavioural approaches embody a line of thinking that moves from the idea of an autonomous individual making rational decisions to a 'situated' decision-maker, much of whose behaviour is automatic and influenced by their 'choice environment'.

Libertarian paternalism (or asymmetric paternalism) is a political philosophy that has been used to support the use of nudge type policies. As there will more often than not be a default option or a way in which information can be framed, libertarian paternalists argue that some form of paternalism is unavoidable as doing nothing is rarely an option. As such, choice architects can use their position to try and direct people towards better outcomes while being respectful of the freedom of the individual. Critics would counter that attempts to manipulate choices are often coercive and patronising, particularly as they may presume that groups of people or whole populations are unable to rationally come to a decision.

This chapter investigates issues around behaviour change (including around public permission, personal responsibility and the relationship between governments and citizens) by looking at three specific factors behind any behaviour change intervention; what the behaviour being targeted is, who the policy affects and how change is going to be brought about.

Introduction

As the profile of behavioural economics and the wider behavioural sciences has grown in recent years, so too has controversy about its acceptability and application to public policy. Policy makers know that attempts to change citizens behaviour may well be controversial. This is particularly true given the emergence of evidence presented in earlier chapters about the degree to which behaviour is automatic, and new ways of applying this evidence (18).

Behavioural insights demonstrate that people are strongly affected by factors that may lie outside of their awareness and control - and this complicates our understanding of personal responsibility and the role of choice architecture. The mechanism through which many 'nudge' style interventions is intended to work often 'deliberately seek' to by-pass rational decision-making processes in order to channel behaviour in the direction preferred by the choice architect (450). In this sense, nudges can be seen as a form of manipulation and disrespectful of individual autonomy and therefore are controversial.

These new approaches are now being targeted across different policy areas. The *Behavioural Insights Team* have produced reports on how this thinking can be applied to not only the health domain but also charitable giving, tax and environmental policy (451). Whilst private companies may use such insights to increase sales and profits, it is presumed that governments and public bodies would structure options to encourage choices that are in the citizen's or society's own best interests. This is part of the political philosophy of libertarian paternalism, in which people's choices are actively guided towards their best interests but they remain free to behave differently if they want to consciously opt out (288).

Libertarian paternalism underpins Thaler and Sunstein's nudge type proposals with their claim that 'the libertarian aspect of our strategy lies in the straightforward insistence that, in general, people should be free to do what they like – and to opt out of undesirable arrangements if they want to do so.. We strive to design policies that maintain or increase freedom of choice. When we use the term libertarian to modify the word paternalism, we simply mean liberty-preserving. And when we say liberty-preserving, we really mean it. Libertarian paternalists want to make it easy for people to go their own way; they do not want to burden those who want to exercise their freedom' (4, 288).

The idea of libertarian paternalism appears to be a contradiction, which Thaler and Sunstein acknowledge in a widely cited paper with the title 'Libertarian paternalism is not an oxymoron' (288). Certainly in the UK, both of the main political parties have supported a perspective encompassing libertarian paternalism that preserves freedom of choice with a more caring and supportive form of government. Such thinking is also influencing public policy in countries outside of the UK including Australia, France and the USA where similar units to the *Behavioural Insights Team* have been established (59). Nevertheless, there has been vigorous debate about the use of policy nudges for example in relation to the change of an opt-out default for organ donation in the UK (452).

A substantial part of my contribution to the Mindspace report involved looking at what evidence existed in the 'field' for the different Mindspace interventions in three areas of public policy. The three specific areas I investigated were *safer communities which* looked at issues including preventing crime and antisocial behaviour; the *good society* looked at areas including pro-environmental behaviours, volunteering and encouraging voting and *healthy and prosperous lives* looked at challenges including stopping smoking, reducing obesity, promoting responsible personal finances and encouraging the take up of education and training (see end of chapter for more information about these areas)**.** A central aim of looking at these three broad policy areas was to

show how some of the different Mindspace elements had already been used to influence behaviour but also to reflect on some important issues in the use of behavioural public policy.

These issues can be broadly examined by looking at what the behaviour being targeted is, who the policy affects and how change is going to be brought about. This expands (or at least complements) the findings of the House of Lords committee that considered the ethics of nudge and set two questions to judge the acceptability of such an approach. Firstly is the the nudge visible in principle (controversy tends to arise with any subliminal advertising). Secondly is the nudge proportionate (5).

What is the behaviour being targeted

There is a lack of clear consensus about what behaviours government or the state should legitimately try to influence. This area is made more complex by public reactions to state intervention being unpredictable and inconsistent. In Mindspace, we discussed two important dimensions that are central to this discussion. The first is whether the effects of any given behaviour are felt by the actor or another party. The second concerns whether these effects are harmful or beneficial. The dimensions of 'self/other and harm/benefit' are a useful means of assessing potential controversy and appropriateness of behaviour change interventions, and this perspective can be traced back to John Stuart Mill's claim that 'the only purpose for which power can rightfully be exercised over any member of a civilised community, against his will, is to prevent harm to others. His own good, either physical or moral, is not a sufficient warrant' (453).

There are important distinctions to consider when considering interventions that target behaviours that affects others and ourselves, and between harms and benefits (454), and these can be discussed in reference to the three different themes that were looked at (safer communities, good society and healthy and prosperous lives). Governments and citizens are most concerned about the impact of people's behaviour on others and especially when this causes harm. Efforts to reduce crime and

disorder fall largely into this category where obvious distress is caused to citizens and the policy policy brief is to stop a behaviour harming others. Strategies to reduce these types of harmful and distressing behaviours tend to be relatively non-contentious type of behaviour change for policy makers to take on and is usually demanded, by the citizens they represent.

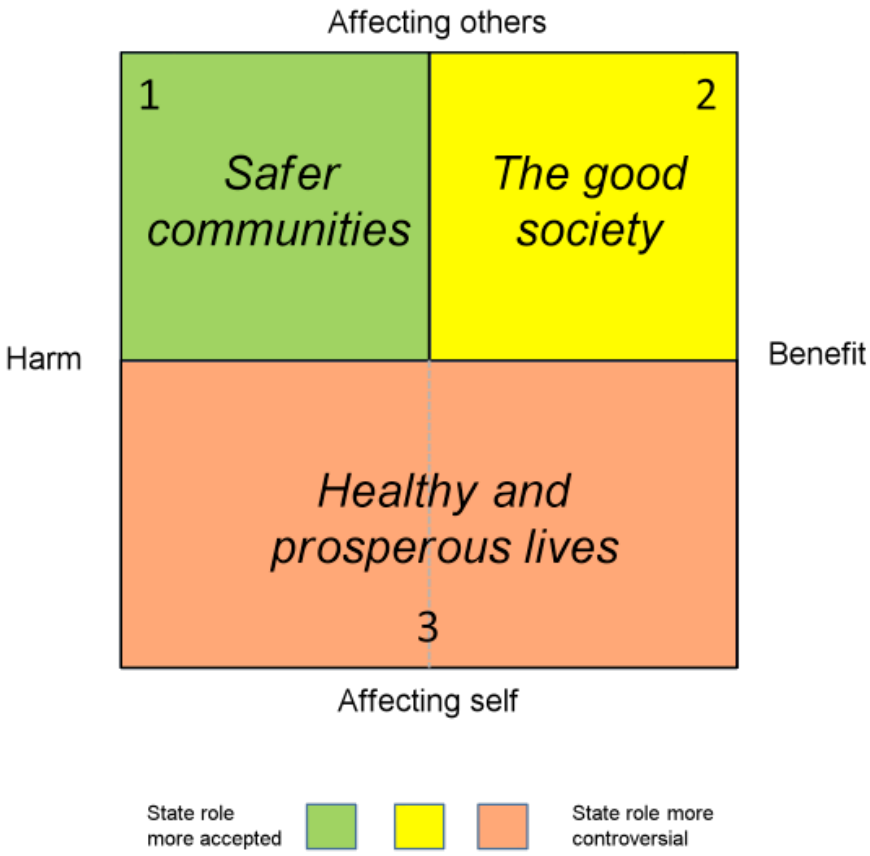
Challenges around the good society also relate largely to the impact on others, but typically in relation to benefits rather than harms. Classic examples include behaviours with a positive impacts on society such as volunteering, paying taxes and recycling. Individual citizens often ‘under-invest’ in such behaviours, making a strong case for governments and communities to try to actively encourage them further.

Challenges in healthy and prosperous lives relate more directly to harm and benefits to the self but these behaviours can have some effects on others (e.g. passive smoking). This is where the support for government involvement may be weaker, since these types of behaviour are often seen as more within the realm of personal responsibility. Policies such as financial incentives that encourage people to stop smoking are controversial (171). Nevertheless, there may be strong financial reasons for acting, such as the Wanless Review’s claim that the cost of a population ‘unengaged’ in its health could be £30 billion more by 2022 than a population actively engaged in taking responsibility for its own health (455).

In Mindspace we combined the two categories of harm/benefit and affecting self/others to help policy makers and practitioners anticipate whether interventions were likely to cause controversy (See Fig 10.1). This matrix predicts that public support will likely be strongest for interventions targeting behaviours that cause harm including to others - particularly violent crime and antisocial behaviour. There may also be support for interventions supporting benefits, but mainly when the positive spillovers are for others.

There is likely to be less support for interventions that relate to harm and benefits to the self. This is of relevance to encouraging healthy and prosperous lives where a significant number of people think that the government should avoid spending limited resources on encouraging people to stop smoking or lose weight as it is in the personal interests of individuals to change their behaviour (52). There is likely to be even less support for government interventions that cause benefits to self (e.g. incentivising people to go the gym). Nevertheless, there can be strong reasons for government action in these areas given the costs of unhealthy behaviours detailed in Chapter 5.

Figure 10.1: Potential for controversy for behaviours affecting self and others and whether they cause benefit or harm (taken from Mindspace)



Who does the policy affect

The finding that much of our decision-making is automatic challenges our understanding of behaviour and has implications for how we view personal responsibility. The strong influence of context and the environment on our behaviour raises questions about whether it is the full responsibility of individuals taking part in harmful behaviours. While it is easy to say that people can resist contextual influences by their reflective mind kicking in, numerous examples of how this may not be the case have been provided in previous chapters. There is evidence for example about the presence of automatic effects of racial discrimination in decision makers who do not consciously hold discriminatory attitudes (456).

When designing interventions it is likely that different people will be affected in different ways by Mindspace effects. Any interventions targeting automatic processing that will predominately affect specific sociodemographic groups will require careful justification. In saying this the public may be supportive of interventions that reduce inequalities given some of the traditional methods of behaviour change have widened disparities rather than lessen them.

By their nature, most information and education programmes that seek to influence health behaviours will work best on better informed and educated people. This is because better educated or wealthier people are often more likely to understand the messages and have the resources to respond to them. Since the 1970s, the smoking prevalence rate among men in the UK has halved but the most deprived members of society has come to form an increasing proportion of remaining smokers (225, 457). Such findings extend beyond health behaviours. For instance, a review by Elliott et al have found that those who are well educated respond better to financial information and education (458). It seems that those who want the education, advice and information are those who change their behaviour, but such advice and information has little effect on those who may not

actively not search for it. So recent attempts to change financial behaviour using the traditional route to changing behaviour has most probably increased the gap in financial capabilities across the UK (458).

Focussing on contextual changes to influence behaviour may in fact be less dependent on income and education than information and incentive based interventions targeting the rational brain. Changing the pensions default to automatic enrollment has been seen to increase uptake across the board. Interestingly, it brought a particularly large increase in take-up for low income workers, eliminating most of the previous differences in participation due to demographic factors (12, 33). Despite these positive examples, it remains far from clear-cut that interventions targeting the automatic system may be a more effective and equitable way of influencing behaviour.

How is behaviour going to be changed

Behaviour can be influenced by a number of different intervention strategies including taxation, information campaigns and legislation. Whilst the public may agree with government intervening to change behaviour in certain areas (e.g. smoking) they may disagree with the means of accomplishing it (e.g. through smoking permits as compared to social marketing campaigns). Sometimes broad intervention categories are disliked and we see that there is often significant controversy when there is the idea of using financial incentives to change certain health behaviours where their use can be seen as bribes to reward poor choices (163).

There are particular concerns with nudge/Mindspace type policies as these effects largely - though not exclusively - operate outside of conscious control and so there may added issues in that people targeted may not be fully aware that their influence is being targeted, opening up charges of manipulation (52). Of course, some traditional policy tools are not explicit, for example some taxes provide little salience to individuals but concerns tend to centre on lack of clarity rather than overt manipulations (94). The use of subconscious nudges can limit the opportunity of conscious consent

from citizens and so there is a real need to think about new ways of gaining consent for the use of such effects which is considered in the later discussion (4).

An alternative strategy that may temper some of these concerns has been put forward by John and colleagues in their book *Nudge, Nudge, Think, Think* (459). Rather than nudging people into certain behaviours we can prompt them to think about the choices made available to them. A good example of this kind of strategy is prompted choice where people are guided to make a decision about joining the organ donor register when registering for a driving license. This is in contrast to being opted in or opted out automatically.

Discussion

The question of when it is appropriate for government or the state to intervene to influence the behaviour of citizens was considered by the Nuffield Council on Bioethics in a 2007 report (460). In their stewardship model an 'intervention ladder' was proposed to highlight the balance between benefit and intrusiveness, with more intrusive interventions requiring stronger evidence of benefit to be acceptable. Increasing the price of alcohol or banning smoking in public may be considered acceptable if there is clear evidence of harm prevention, particularly where vulnerable people are protected. The need for robust evidence further supports the need for rigorous evaluation to ensure that interventions are well-designed and cost effective and do not have harmful consequences (5).

While many people dislike the thought of Government or other institutions intruding into areas of personal behaviour and responsibility, a majority do support the state's role in behaviour change. Whilst almost half of people think that people should be responsible for their own decisions about health and welfare, the same people have also been found to believe that government also have a role in encouraging healthier lifestyles (461). In relation to pensions, whilst participants in an evaluation exercise wanted to be in control of decisions about their own pensions they also wanted to be told what to do as they were unsure they could make the right decisions for themselves (462).

Two recent reports by the OECD and Faculty of Public Health (FPH) have also concluded that the public are not as negative toward state intervention as may often be assumed (463, 464). In the YouGov poll carried out on behalf of the FPH, 1448 adults across the UK were asked about the role of government in behaviour change. There was strong support for policies including making 2 hours of sport per week compulsory in schools, a move to an opt-out system for organ donation and banning anyone from smoking in a car when children were on board.

Knowing the impact of different interventions targeting automatic processing on our behaviour, policy makers could seek to ban behavioural change approaches to avoid being accused of manipulation. But the reality is that the choice environment is rarely neutral and choice architects are always going to be shaping decision making. Entry onto the organ donor register can be mandatory, opt-in or opt-out. The figure delivering the message to get the annual flu jab may be a physician, politician or representative of the general public. Knowing what we know then such conditions will nudge citizens towards one decision or another and policy-makers need to understand that we are being influenced – and influencing others – all the time. An important question that perhaps is not answered well is who is the 'choice architect' that designs the 'choice environment'. One way of thinking about this is to view the role of the policymaker or practitioner as trying to shape influences around us to maximise the public and private good, while also leaving as much choice in the hands of citizens as possible. This is what is known as 'libertarian paternalism' (288).

Even if people agree with the behavioural goal, they may object to the means of accomplishing it. There is a broader debate here about the acceptability of all the different forms of government interventions to change behaviour but the focus here is largely on the tools that can be applied using insights from behavioural economics. More powerful and subtle behaviour change interventions, may provoke significant concern. So before policy-makers considering the introduction of a

behaviour change intervention, they need to determine whether they should be attempting to change behaviour in the first place. It is vital that where possible the public's views are taken into account when introducing interventions and permission sought. Perhaps the best advice is for each proposal to be evaluated on a case by case basis and in light of the broader context in which it is being introduced (450).

The actions of policy makers are legitimised by the consent and approval of citizens and service users. Automatic processing of the choice environment, limits the opportunity for conscious consent and therefore the public need to be made aware that interventions are being implemented and where possible, give their informed consent. It is also true to say that some of the mechanisms exploited in 'nudges' work 'better in the dark'. People made aware that their choices in the cafeteria have been manipulated may be less inclined to go with the grain of behaviour. Getting consent for each intervention may be problematic and so public permission could be gained from new forms of democratic engagement. There have already been good examples of this in relation to a major change in pensions policy that drew on principles from behavioural economics. In 2006, over 1000 participants took part in the interactive 'National Pensions Day', and voted using keypads (465). With the proposed change to an opt-out policy for entry onto the organ donor register in England, engagement was central to the final conclusions reached (which was to remain using the opt-in system). The subsequent decision to move presumed consent in Wales followed a similar programme of public engagement (452).

Public acceptability should not of course be the only reason for going forward with behaviour change. Consider, for example, the shifts in attitude of the public following the London congestion charge or public smoking bans in Scotland. Public support for both grew considerably following their introduction (466, 467). Alongside the general public's increasing acceptance of the ban on public smoking, interestingly the percentage of smokers supporting the ban in Scotland also

increased from a low of 19% supporting legislation before the ban to 37% shortly after its introduction. The role of experiences on preferences is an under researched area, and it could be more generally that what people want before a policy is different to what they want after it (52). Better theoretical modelling of shifts in opinion – and changes in wellbeing – given the expected impact of an intervention could provide enhanced permission for policy makers developing contentious interventions.

A behavioural approach to policy design also raises issues around personal responsibility with concerns that if individuals think the state is making decisions them, then personal responsibility for our own behaviour may be absolved. Personal responsibility is a major issue with all the major political parties in the UK and is listed as one of the current coalition administrations three core concepts for government (468). The Mindspace report discussed the perspective that some viewed the relationship between government and individual responsibility as a 'zero-sum' game where any 'increase in government attempts to take on responsibility meant a decrease in the needs taken by the individual', in other words, 'if the state's taking responsibility, that means I am not' (52). But in Mindspace it was argued that it was 'perfectly possible' for government to supply just the trigger or support for individuals to take greater personal responsibility. In this way behaviour change can be framed as 'a pathway to increased personal responsibility' (52). This is reinforced by work demonstrating that even small changes in one behaviour can initiate and reinforce related behaviours (123). Asking health service users to sign a commitment contract stating they will attend clinic appointments (currently up to 25% of patients in some parts of London simply do not turn up to their appointment (134)) may do more than just encourage attendance, but may lead to broader improvements in the service user-provider relationship. Providing salient information about the cost of laboratory investigations to health professionals may help them to think more widely about cost containment strategies (3).

Examples of Mindspace applied to safer communities and good society

	Safer communities	Good society
Messenger	The reaction to information specifying what is and what is not socially and legally may be influenced by who the messenger of that information is.	If people do not support government interventions that encourage pro-social behaviours then it may be more effective to use messengers that are not seen as agents of the state.
	The anti-gang programme 'Ceasefire' uses mothers to deliver messages to gang members and has been successful at reducing gang violence (487).	The Aim Higher programme has seen secondary school pupils successfully mentored into higher education by University students (535).
Incentives	Behavioural shaping may be achieved through positive incentives for good behaviours rather than through negative incentives (penalties) for bad behaviour.	Providing incentives to promote pro-social behaviours can risk reducing intrinsic motivation to make the right decisions in other areas .
	Many current parenting programmes focus on praising or rewarding small steps towards positive behaviour.	Monetary incentives may be more likely to be counterproductive for public pro-social activities than private ones (534).
Norms	The propensity to commit crime or to cheat is influenced by pervasive local norms.	People have been seen to contribute more to society when they see others contributing as well.
	Peer or teen courts can be effective as a consequence of young people being sensitive to social norms of their peers (533).	The British Election Survey found that people were less likely to vote if they felt their peers did not see the value in voting (532).
Defaults	An effective use of default settings to reduce crime comes in the form of 'target hardening'. Default setting may be used to reduce the risk of crime (e.g.speed limiters on cars)	Defaults payments or top up fees could be added to the cost of products or services to increase charitable or community giving.
	Default security settings on new mobile phones may reduced associated crime which has become a major problem in recent years (531).	Donations to public parks in Washington state significantly increased following a default charge on driving license applications (530).

	Safer communities	Good society
Salience	Salient cues in the environment can draw attention to rules and regulations governing behaviour.	Choice overload refers to the problem where some consumers are faced with too many options and it often leads to poor decision-making (529).
	Lines approaching junctions and chevrons on roads can draw attention to need to drive more carefully (4).	People may be overwhelmed by range of options for recycling. Salient colour-coded containers increased recycling rates by 34% (528).
Priming	Criminal activity can be made more likely by factors in the environment that can 'prime' an offenders behaviour.	Features of our surrounding environment could help prime pro-social behaviours.
	Good lighting and clean, open spaces contribute to perceptions of public safety (527).	Exposure to songs with pro-social lyrics increased altruistic helping behaviour (526).
Affect	Bringing offenders face-to-face with their victims can evoke a strong emotional response such as anger or guilt.	Social marketing campaigns have used the power of affect to stimulate pro-social behaviours.
	The Hait scheme in the Netherlands found 60% of participants reduced re-offending compared to 25% in comparison group through a restorative justice programme (525).	Social marketing techniques could be used to encourage behaviours such as blood donation and community volunteering (524).
Commitment	Commitment devices could have a powerful role in reducing or preventing undesirable behaviours.	Reciprocity could be used to improve social cooperation through citizen-to-citizen support schemes.
	Anti-social behavioural contracts can be effective in reducing antisocial behaviour (523).	In Japan people are able to earn credits for looking after elderly neighbours. These can be used to support care for relatives who live further away (456).
Ego	Crime is often tied up with a struggle for respect and self-image is important for criminal offenders.	Enhancing the status of individuals who contribute to their local communities may encourage more people to take an active role.

	Safer communities	Good society
	Although commitment devices have been successful there are concerns that anti-social behavioural orders (ASBO's) can be seen as badges of honour amongst some people and may exacerbate criminal and antisocial behaviours.	'Community champions' in Essex have been successfully used to help encourage members of the public to inform the council about problem issues (522).

Chapter 11

11. Conclusions

Behavioural insights and health policy

The last few years has brought substantially and significantly new ways of conceptualising and framing behaviour change in public policy. Human behaviour is extremely complex and is influenced by multiple genetic, social and environmental factors. Changing behaviour is difficult as we have seen from many failed attempts in the past, but significant potential exists in utilising the latest insights from across the behavioural sciences.

In **Chapter 1**, I began with an overview of System 1 and 2 processes and the enhanced recognition that whilst both systems are important in explaining behaviour, System 1 processes have been relatively ignored to date. The two ways of conceptualising decision making suggest two routes for behaviour change. Traditionally, behaviour change in the health domain has been seen through the lens of 'changing minds' - that is if we can change the way people think (their beliefs, attitudes and goals), then we can influence how they behave. But if you have got this far, then it may be apparent that we should not be relying on peoples capacity for rationality. This fact is increasingly recognised by governments, keen to meet the challenge of healthcare-related behaviours that lead to sub-optimal and costly outcomes.

In the 2010 'Programme for Government' report by the then coalition government 'the assumption that central government can only change people's behaviour through rules and regulations' was rejected and instead it was set out that 'our government will be a much smarter one, shunning the bureaucratic levers of the past and finding intelligent ways to encourage support and enable people to make better choices for themselves'(5). Behavioural economics explores how theories and models in economics change when we take account of the cognitive biases and irrationalities that were described in the early chapters of my thesis. Evidence from behavioural economics and the

wider behavioural sciences has shown the importance of contextual factors on our behaviour and there is increasing interest in applying these insights as interventions in health policy. Many examples of such policies across wider public policy and more specifically in health policy are described in **Chapter 2 and 3**.

In only a few years that coincided with me completing this thesis, behavioural economics has moved from a fringe activity to a point where a *Behavioural Insights Team* sits at the centre of UK government and similar organisations have been established in the USA and Australia. These units have drawn on empirical and academic evidence as well as support from leading behavioural scientists. Behavioural economics may have entered the limelight with the publication of Thaler and Sunstein's book *Nudge* (4), but the insights are built on decades of work that are only just being applied in policy making with any clarity and purpose. *Nudge* challenged the dominance of rational choice as the theory underpinning much of public policy and has replaced it with an understanding that reasoning processes based on cognitive shortcuts can lead both to effective as well as suboptimal choices. The enhanced understanding of decision-making we now have allows us to harness the ways people actually respond and behave. By understanding the biases which drive behaviour, polices can be shaped which counter or actively make use of these tendencies.

The decision-making environment in health care is fertile ground for the use of behavioural approaches, given the widespread influence of context on people's choices and the limited ability of standard economic models to explain their behaviour (469). The dominant theories of health behaviour have focused on reflective precursors (47, 48) opening up opportunities for new thinking to meet the huge challenge of poor decision making in healthcare. Healthcare systems have so far failed to fully recognise the importance of context in decision making and not appreciated that people are risk averse, follow the behaviour of others, heavily favour rewards today over tomorrow, and tend to stick with the status quo. This failure to appreciate the reality of how people actually

behave has limited the effectiveness of traditional policy tools aimed at improving health outcomes (including the cost effectiveness of care).

A better understanding of behaviour and the influences which underpin it should allow policy makers to design new and enhanced ways of improving clinical outcomes and containing cost (the potential for this in relation to curtailing excessive healthcare spending is explored in **Chapter 4**). Some areas of health care have warmed more quickly than others to the idea of understanding the role of behaviour in care delivery and intervening where problems are identified. In patient safety, the study of 'human factors' has adopted the techniques of psychology, engineering, and design to minimise the risk to patients from clinicians' all-too-human behaviours. Simple, low-cost approaches to normalising and systematising clinical activity have already been found. A notable example is the World Health Organisation's surgical safety checklist, which not only has been shown to improve clinical outcomes but also saves nearly $26 every time it is used during an operation (470).

It is easy to forget sometimes how difficult choices in health can be - both for the users and providers of services. Whether it is a member of the public choosing a health insurance policy or a physician choosing what medication to give for a patient with hypertension, there are often dozens of complex options to choose from. It is essential that support is provided to people taking such decisions to help better align outcomes with underlying intentions. Ariely gives an example of someone tasked to design a road system/highway. If every driver was presumed to be sensible then there would be no need to worry about any of the dozens of measures that most of us are familiar with that prevent us from error. Obviously no sensible road planning department would do such a thing, but when it comes to designing the choice environment in the health domain, blind faith in human rationality often holds. In healthcare we often assume that humans can figure out any choice we provide them with despite significant evidence to the contrary. The IDEAS project described in

Chapter 6 investigated how choice architecture can be successfully used to influence provider behaviour where complexity has contributed to frequent errors being reported (it is estimated that approximately 10% of all medication orders in the NHS contain some type of error).

For those questioning the place of behavioural insights in healthcare, it is hard to think of many choices that can be presented in a neutral way explaining why context is so important. An organ donation register must have a default policy of opt-in or opt-out and supermarkets need to put items on their shelves in some sort of order. Where some form of choice architecture is required it would seem sensible that it be used to favour most people's underlying intentions. These would generally correspond to helping people live longer, healthier and happier lives and have the added benefit of ensuring health systems can provide sustainable, high quality care.

Certainly there is an appetite now that did not exist even five years ago to use nudge type interventions in healthcare. The U.K Department of Health have stated that they will explore *'nudging people in the right direction rather than banning or significantly restricting their choices'* and that *'there is significant scope to use approaches that harness the latest techniques of behavioural science'* to enable people to make healthier choices (471). Andrew Lansley (then the Secretary of State for Health) stated in his 2010 public health white paper that 'nudging people to behave in certain ways should be the main approach taken in public health from now on' (471). Such a transition in how we develop and implement interventions in healthcare may take some time to implement, but certainly more thought is being given to policy tools targeting automatic processing (267). In the course of my thesis, an internal *Behaviour Change Unit* has been established in the Department of Health to more widely implement Mindspace type interventions. At Imperial, we have been working collaboratively with the team in in supporting research projects research projects in areas including reducing missed clinic appointments and improving cancer screening attendance.

The Mindspace framework explored throughout my thesis set out explicitly to provide policy makers and practitioners with an accessible summary of the wider literature, providing an opportunity to put these insights into practical use. Mindspace provides a more unified theory for designing interventions rather than a collection of interesting insights (that *Nudge* provided*)* and its popularity amongst policy makers hints at its potential to facilitate the wider application of behavioural insights in public policy. Messengers, responses to incentives, social norms, default settings, salience, priming, affect, commitment and ego all matter to behaviour and are important concepts to understand for those developing health and wider policy. Alongside developing new interventions, policy makers and practitioners can use Mindspace to better understand the various effects on behaviour their policies may be having.

While there is optimism in policy making circles about the application of behavioural insights, there remains a lack of consensus about the evidence base that supports nudge/Mindspace. Whilst four decades of research in the behavioural sciences has improved our understanding of human behaviour, there is less evidence about how this knowledge can be applied in practice to change the health behaviours of individuals and populations. In the Mindspace report, we (the authors) were 'confident that behavioural economic approaches offered policy makers powerful new tools' but still felt that a significant degree of uncertainty remained (52). Marteau in her BMJ article '*Judging nudging'* said that 'nudging certainly works' and that 'shaping environments to cue behaviours in extremely effective'(21). A House of Lords enquiry led by Baroness Neuberger was more reticent and felt that after an assessment of the evidence, although behavioural insights were a welcome addition to the policy toolkit, it was not felt that nudge type policies make significant impacts on behaviour and that conventional policy tools were still required (472).

In nearly every instance the strongest empirical evidence for applying behavioural insights emerges from laboratory studies rather than the field (289). Legitimate concerns exist about whether these

laboratory findings generalise to the real world, and many interventions await rigorous evaluation. Going forward, there is a clear need to build on the credible evidence base for nudge/Mindspace interventions (36), but there are already examples of how such policies are already having an impact although these largely lie outside of the health domain (12, 17, 289). The research studies presented in this thesis as well as further projects undertaken by our wider team will add to this evidence base in healthcare and should help support further work in the future

Behaviour change policy is complex. We know that some interventions work in certain contexts but that does not mean they will translate to all policy areas. In addition, it is unclear how lasting many of the effects described through latest behavioural insights are, how effects that work in one set of circumstances will work in another, and whether effects that work well with one segment of the population will work with another. However, these issues may reinforce the need for more, rather than less, thinking and research in this field. We need to understand better the range of factors that affect behaviour, and good evaluation is the only way to do this. Government's spends huge sums on interventions that have sought to change behaviour. Unfortunately, a lack of thought about how to robustly evaluate impact means that it is often difficult to provide evidence of effectiveness. The size and nature of the intervention, its aims and objectives and the underlying theory of behaviour change used should determine the form of evaluation. As evaluations can be complex, there should be greater collaboration between policy makers and academics. We should be applying the same rigour we do to the evaluation of pharmaceuticals and medical devices to evaluate behaviour change interventions.

The best evidence will come from randomised experimental variation being induced such that some subjects are randomly assigned to receive one policy treatment, while others are randomly assigned to a control group. Where possible field experiments should be used (rather than laboratory experiments) using carefully crafted exogenous variation in real world environments. This will

allow us to identify causal relationships and the mechanisms underlying them (5). Issues and guidance around improved intervention design, implementation and evaluation are captured by the 6 E's framework described in **Chapter 5**.

It seems sensible to make better use of pilot studies before rolling out expensive wide-ranging interventions. Most of the evidence on behaviour change has been generated in precisely designed laboratory experiments and the next step is to transfer insights from the laboratory into designing field experiments that take place in natural environments. The field study investigating the role of olfactory priming and hand-washing described in **Chapter 7**, followed on from a previous laboratory study we had undertaken and published (334). Field studies allow us to understand how people actually engage with policy in the real world, and in doing so can reduce any focusing effects and selection biases. Only after demonstrating effectiveness in the field and cost effectiveness should we consider rolling out full-blown interventions. Research should also determine the relative effectiveness, and also cost-effectiveness, of the various cues and control systems for different health behaviours. In so doing, we can develop basic behavioural science into evidence-based policy.

The application of behavioural insights to health policy does not mean giving up on conventional policy tools such as regulation, price signals and information. One of the charges leveled at supporters of approaches such as that offered by 'nudging' is that they do not canvass the full range of intervention types. But very few supporters of behavioural approaches have discounted the use of more conventional tools of government intervention where they are shown to work. Marteau felt that 'without regulation to limit the potent effects of unhealthy nudges in existing environments shaped largely by industry, nudging towards healthier behaviour may struggle to make much impression on the scale and distribution of behaviour change needed to improve population health to the level required to reduce the burden of chronic disease in the UK and beyond' (21).

Loewenstein and Ubel, two prominent behavioural economists, have argued for the application of old fashioned monetary incentives in preference to nudge type policies in certain circumstances. An example they give is the attention recently given to calorie labelling in New York. It was felt that a better way of tackling obesity was to make unhealthy food more expensive. Such tools may be more labour intensive and expensive but they should continue to have a role alongside nudge/Mindspace interventions.

There is a need to better develop the specifics of interventions that join up interventions that seek to change behaviour through more subtle nudges alongside the harder 'shoves' of legislation. Interventions should be designed to complement each other to provide a comprehensive coverage of all the important aspects underlying sustainable behaviour change. Drink driving demonstrates how the combination of strict penalties, effective social marketing and shifting social norms can have a big impact on behaviour - even if it takes a few decades to work. Multimodal interventions will require an integrated approach between policy makers, academic researchers, (health) practitioners and members of the target population.

It is clear that technology is transforming the way people live and interact with each other. With near ubiquitous access to mobile communication technologies, the way people communicate and access information has been transformed. These devices and software platforms provide tremendous opportunities for us to better understand human behaviour and deliver interventions in the right time and place. I touch on the potential for this in **Chapter 8 and 9** and am enthusiastically pursuing work in this area going forward.

Whether interventions are delivered by letter or SMS text messages, certain ethical and political considerations need to be more fully considered in determining whether it is appropriate to target automatic processes of judgment to change health behaviours (such issues are discussed more fully in **Chapter 10**). Policy levers that act outside of conscious control are likely to be controversial and

will require new ways of policy makers involving and engaging citizens. These issues are more comprehensively explored in the previous chapter but there are important questions about who decides on this choice architecture in healthcare and on what basis. Many people dislike the thought of government (or even health professionals) intruding into areas of personal responsibility, though they also realise that the state should have a role in behaviour change, especially when one person's behaviour has consequences for another person's well-being. So before policy makers consider how they can apply new insights, they need to determine whether they should be attempting to change behaviour in the first place.

In many instances, choice architects will be shaping decisions whether they like it or not. Where possible, we should be doing what we can to construct the choice environment in a way that is more likely to improve health and wellbeing rather than worsen it. But even if intentions are good, policy makers and practitioners need to think about issues around personal responsibility, public permission and equity when designing and implementing interventions.

The future direction of behavioural policies

Although some commentators (including politicians like Andrew Lansley) have suggested that nudging represents a radical change to how health policy could be approached, most people working in the field are more circumspect. While we can be confident that behavioural insights offers powerful new tools, there is still much to learn and much that can be done with traditional approaches to behaviour change.

As we continue to see more reported studies and policy ideas incorporating behavioural insights it is worth considering the future direction of this fast moving field. Central government continues to broadly support nudge type policies and have renewed funding for the work of the *Behavioural Insights Team*. The Department of Health with many other government departments has established internal behavior change units who are supporting a number of robust trials. So the future looks

bright for the application of behavioural science in health and wider public policy. The increasing interest shown in behaviour change has brought new avenues of research into focus where there is potential to influence sustainable and cost effective behaviour change. I will finish my thesis by describing two areas of work that marry up behavioural insights with technology and design and have become the focus of my ongoing interests in behaviour change.

On a personal level, being introduced to behavioural economics has opened my eyes to a new way of thinking and working. As a clinician and researcher, a better understanding of the science of behaviour change has allowed me to think about how I can apply this theory to practice. Behavioural design and gamification represent two areas where a knowledge of loss aversion, status quo bias and priming can translate directly into meaningful health related behaviour change interventions.

Behavioural design

An image of a fly etched into the male urinals at Schipol airport in Amsterdam provides one of the most recognised examples from the book *Nudge* and also neatly demonstrates how the design of the physical environment can promote specific behaviours. For people not familiar with this famous fly (see Fig. 11.1), it appears that men like to aim at something whilst urinating and the fly is a welcome target as its presence significantly reduce unnecessary spillage (4).

On a (perhaps) more serious note however, there are many examples of how design solutions can change human behaviour. Emergency departments have been redesigned to successfully reduce violent incidents towards staff, infusion connectors prevent drug therapies being given through the inappropriate route and nozzles from diesel pumps prevent drivers putting the wrong fuel into their car (25).

Figure. 11.1: Toilet fly, Schipol airport



There exists significant potential in designers translating insights from behavioural science into products and services that can improve health and well-being. Design practices - both academic and commercial - are moving away from a focus on aesthetics and usability to incorporate interdisciplinary knowledge from fields like behavioural economics and neuroeconomics. Behavioural economics and the wider behavioural sciences helps us understand why people behave and choose as they do by drawing on insights from psychology, economics and neuroscience. The design approach can use these insights in a pragmatic way to help drive people towards better choices. Elements of the physical environment or products and services may either enable behaviour change by making it easier than alternatives or constrain behaviours by making certain actions difficult or even impossible.

Behavioural design can be used to target both System 1 and System 2 processes and has the potential to succeed where decades of education programmes and awareness campaigns have failed. Speed humps are an example of a cue that invites people to rationally consider whether to reduce her speed to avoid damage to her vehicle and the discomfort of driving swiftly over the hump. In

contrast, the fly etchings in the Schipol urinals are designed to alter behaviour by taking advantage of cognitive irrationalities, rather than appealing to individual reason.

The next few years will confirm the potential of behavioural design. A Behavioural Design Lab has recently been established as a collaboration between Warwick Business School and the Design Council. The HELIX centre (www.helixcentre.com), a collaboration between Imperial College London and the Royal College of Art where I am the clinical lead has also launched and is working on influencing health related behaviours through the intelligent design of products, services and places. At the time of making corrections to my Thesis we had opened our design studio in a prominent position of the St Mary's Hospital Campus and had brought together over a dozen designers, behavioural scientists and clinicians to work collaboratively together on behavioural design projects (see Fig 11.2). Examples of ongoing work include a design led package to encourage people to complete bowel cancer screening (currently over 50% of people do not) and the development of rehabilitation equipment that encourages patients to exercise after their operation.

Figure. 11.2: The HELIX Centre at the St Mary's Campus of Imperial College London



Gamification

Gamification is a purposely-broad umbrella term used to encompass the process of using 'gaming' or behavioural elements to motivate and engage people in non-game contexts (473). Gamification has come to prominence in the last five years given the enhanced opportunities that now exist to deliver behaviour change interventions through game platforms on new smartphone (e.g. iPhones, Samsung Galaxy) and tablet (e.g. iPads) devices.

Digital 'games with purpose' have the potential to improve health by integrating game mechanics with public health theory and behavioural insights. Defying traditional stereotypes, people across demographic boundaries now play video games on a wide range of digital devices (474). Whilst such games continue to be primarily used for entertainment purposes, there is increasing interest in their potential to influence positive changes in health behaviours (475). This has been encouraged by the finding that rather than spending hours being sedentary and chasing intangible outcomes, players of active video games (e.g. Nintendo Wii Fit) are motivated to exert themselves to achieve activity goals through game mechanics (476, 477).

Whilst still in its infancy, gamification is becoming an increasingly familiar concept in healthcare as a consequence of two trends. The first builds on the consumer's appetite for new information and communication technologies particularly smartphones (the potential for mHealth was discussed in **Chapter 9**) that provide games designers with a wider audience to target and more attractive tools to use in designing interactive health interventions. The second factor is the enthusiasm and willingness of developers to incorporate the latest behavioural insights into electronic interventions.

Mobile phones have been shown to be effective platforms for delivering health interventions (including for smoking cessation and encouraging medication adherence) (372, 403). Features of smartphone handsets that make them a useful delivery vehicle for gamification in healthcare include

GPS services, inbuilt accelerometers (that measure movement) and external sensors (that can measure heart rate and blood pressure) (341).

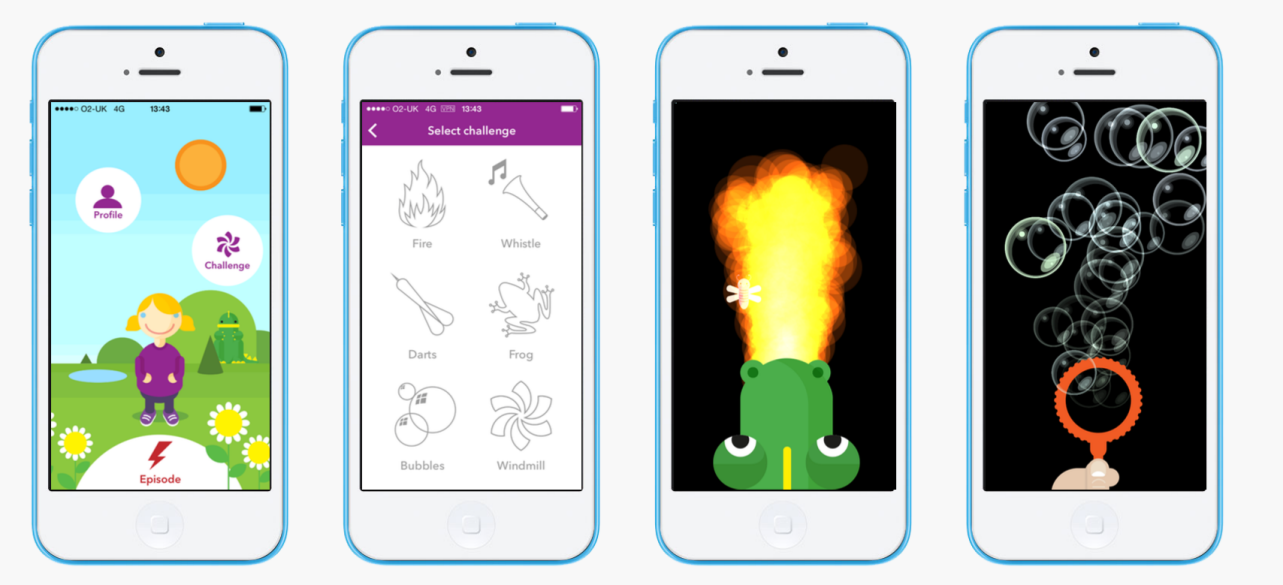
Video games are designed to motivate users behaviour and whether knowingly or not, insights from behavioural economics are related to many of these features. For example, many games provide conditional rewards (e.g. points and prizes) that risk being lost if gamers do not return frequently to play. This plays on the well-known tendencies of for people to avoid losses (loss aversion) and to irrationally value things they hold over things they do not have (endowment effect). The gamer's refrain is often ' Just one more level'. The question is can this be turned into a health advantage?

Empirical evidence to support gamification in health is starting to emerge (475). Some of the best examples of gamification are exergames that encourage exercise by turning physical activity into a game (478). The use of mobile phones for these games has obvious advantages as handsets can be used to support and monitor outdoor activities. Exergames supported by GPS services on mobile phones include Nike + Fuelband and RunKeeper. These platforms are widely in the UK, with activity and achievements are often tracked on social networks like Facebook and Twitter. Games have also been created for specific health conditions. An example is Bant, a mobile app targeted at adolescents with diabetes that has successfully used incentives to improve the frequency of glucose monitoring (479).

Going forward, there are a number of issues that need to be addressed for gamification platforms to be successful in influencing ingrained health behaviours. 'Games with purpose' will need to hook people in the same way that games for fun entertainment currently do. The success of platforms will be related to the motivation and engagement of the players and this will often depend on experienced game developers building good games. The input of clinicians and behavioural scientists will also be essential to delivering effective interventions that are grounded in a theoretical framework that allows testing of hypotheses. I am currently working with a team of

games designers, behavioural scientists and other clinicians to achieve this. An example of our work in this area is Puffle - an innovative asthma engagement platform for children with asthma. Using the features of a smartphone we encourage users to measure their respiratory peak flow through the use of number of well designed games (see Fig 11.3).

Figure. 11.3: Screenshots of Puffle our asthma engagement platform that incorporates gamification elements



12. Outputs from PhD

Publications

- King D, Jabbar A, Charani E, Bicknell C, Wu Z, Miller G, et al. Redesigning the 'choice architecture' of hospital prescription charts: a mixed methods study incorporating in situ simulation testing. BMJ Open. 2014;4(12):e005473
- Lee, H , Vlaev, I , King, D , Mayer, E , Darzi, A , Dolan, P. 2013, Subjective well-being and the measurement of quality in healthcare, Social Science & Medicine, Pages:27-34
- 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. 32:4661-668
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- King D; Ramirez-Cano D; Greaves F; Vlaev I; Beales S; Darzi A. (2013). Twitter and the health reforms in the English National Health Service. Health Policy. 110:291-297
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- Howitt P; Darzi A; Yang GZ; Ashrafian H; Atun R; Barlow J; Blakemore A; Bull A et al. (2012). Technologies for global health. The Lancet. 380:507-535
- Dolan P; Hallsworth, M; Halpern, D; King, D; Metcalfe, R; Vlaev, I. (2012). Influencing behaviour: the mindspace way. Journal of Economic Psychology. 33:264-277

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- King D; Hallsworth M. (2011). Getting the best from behaviour. Public Service Review: Health and Social Care. 26-27

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- King, D. *Imperial IdeasLab: Behaviour change through mHealth*, World Economic Forum 2014. Davos
- King, D. Creating healthier outcomes, World Economic Forum 2014. Davos
- Darzi, A; King, D. Innovating to reduce the costs of healthcare. Health Affairs: The Triple Aim Goes Global, Washington DC. 11 Apr 2013. (2013)
- King D. MINDSPACE: an operating framework for behaviour change. Faculty of Public Health Annual Conference, Jul 2011.
- King D. Behavioural theory and policy. Holyrood Social Marketing Conference, May 2011.
- King D. How do you change behaviour: and where does responsibility lie. Scottish Food and Drink Administration. Your Food. Your Health. Your Industry: Working together for change, May 2011.
- King D. Influencing behaviour: to nudge or to shove. Local Government Association Annual Conference, May 2011.

Grants awarded

- £2.8million – HEFCE

Co-I - HELIX Centre (Health Innovation Exchange Centre)

- $988,892– Qatar Foundation

Co-I - Adapted Cognitive Behavioural Approach to Addressing Overweight among Qatari Youth

- £150,000– Imperial BRC FundCo-I

Surgical pathway app

- £7,200,000 – NIHR

Co-I – NIHR Patient Safety Translational Research Centre

- £8000 – Cabinet Office Strategy Unit

PI - Improving the design of inpatient drug charts using behavioural science

- £150,000 – NHS London

Co-I – Design and development programme for strategic improvements to the emergency ambulance

- £850,000 – Department of Health

Co-I – Personalised health budgets evaluation

Advisory Roles

- Behaviour Change Unit, Department of Health

- Health and Social Care Group, Parliamentary Labour Party, House of Lords

- Weqaya Expert Advisory Committee, Health Authority Abu Dhabi
- Behavioural Insight Team, Cabinet Office Strategy Unit
- National Institute for Health and Clinical Excellence Expert Panel on Behaviour Change
- Personalised Health Budgets Steering Group, Department of Health
- Department of Health Expert Group on Behaviour Change

Impact of work from thesis

- Mindspace (whose development I contributed too) has served as the operating framework for the work of both the *Behavioural Insights Team* at the Cabinet Office (established 2011) and the *Behaviour Change Unit* at the Department of Health (established 2013)
- A number of government white papers have been published that utilise the Mindspace framework including in relation to health, energy consumption and charitable giving
- MINDSPACE has been widely discussed in the popular media including the BBC, Independent, Guardian and Daily Telegraph
- Health Affairs paper (Approaches Based On Behavioral Economics Could Help Nudge Patients And Providers Toward Lower Health Spending Growth) discussed in Healthcare Finance News[1]
- IDEAS prescription chart project a focus for a BBC Radio 4 programme[2]
- Contributed to feature on SkyNews about Gamification
- Work in mHealth and Twitter contributed to two spin-out companies - www.DigitalStitch.co.uk and www.t-index.com

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[1] http://www.healthcarefinancenews.com/news/grasping-healthcare-spending

[2] http://www.bbc.co.uk/programmes/b016ldtj

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Appendices

Appendix 1: Case studies from Mindspace

Case Study 1: Reducing gang violence in Strathclyde

The policy issue

The latest British Crime Survey (BCS) reports that violent crime has fallen by 49% since 1995, with provisional data showing 648 murders recorded by the police (the lowest in 20 years). The use of knives in all violent crime has remained fairly stable over the last decade (480). Although gun crime remains very rare, the number of recorded crimes involving firearms (excluding air weapons) doubled between 1998/9 and 2006/7 (481). Considerable public concern exists about knife and gun crime: 93% of BCS respondents thought knife crime had risen nationally, with 86% thinking the same for gun crime (482).

Many of these concerns have related to the activities of 'gangs'. It is extremely difficult to measure gang membership, but a 2004 Home Office study estimated that 6% of young people aged 10-19 belonged to a youth group who were actively involved in criminal activity. Members of such gangs were more likely to have taken illegal drugs and to have a criminal conviction (483).

Using norms and messengers to change behaviour

It has been shown that people are strongly influenced by the behaviour of others, particularly by those who are similar to themselves. If delinquent and criminal behaviour is seen as 'normal' and is widely practiced by peers, this creates a strong attraction for gang members to join in and conform to the norm. Scotland's Violence Reduction Unit has taken an innovative approach to tackling Glasgow's gang culture, which is founded on turning the power of social norms against gangs. Previous initiatives – including foot patrols and crackdowns on knife crime – had achieved only short-term success (484). Then Scotland's Violence Reduction Unit turned to a US programme

called the Cincinnati Initiative to Reduce Violence (CIRV). A central plank of CIRV's approach is to make one gang member's actions affect all his/her peer group. So, if a gang member commits a murder, then the entire gang is targeted for offences: drug activities, weapon possession, and parole and probation violation. In other words, punishment is replicated in the same way as the delinquent behaviour was – through the social norm of gang membership.

The American programme adopts other tactics for 'changing operative norms regarding violence'. Gang members were summoned to face-to-face forums as a condition of their parole. One purpose of these forums was to show how the gang's 'rules' or 'code' was based on illusion and rarely operated in reality. The other main purpose was to draw on wider social norms, by getting members of local communities, victims' relatives and ex-offenders to speak about the impact of the gangs' violence on their area.

The messages have proven most effective when coming from figures that gang members may respect, or to whom they can relate – as when the mother of a dead gang member warned: 'If you let yourself get killed, your mother will be standing here. She will be me (484).' As one of the American scheme's architects has noted, 'We're finding all of this matters more if you can find someone who is close to the offender, who they respect, who will reinforce these values.'(485) This points again to the power of the 'Messenger' effect, explained above.

Evaluation

There have been a series of gang violence initiatives, all based on a similar model from the United States. One of the first programmes, Ceasefire, has been well evaluated. When first launched in Boston in 1996, an evaluation for the US National Institute of Justice found that the intervention reduced the average number of monthly youth homicides by 63%.(486)

A more recent evaluation of a programme based on the Boston project found that shootings and killings dropped between 41% and 73% in Chicago and Baltimore; declines of between 17% and 35% were attributable to Ceasefire alone.(485) In Cincinnati, gang-related homicides fell by 50% in the first nine months.(484) These improvements appear to be enduring – once a new social norm has been embedded, it becomes self-sustaining.

Scotland's Violence Reduction Unit secured £1.6million of funding for their own CIRV (Community Initiative to Reduce Violence) project in 2008, which has brought together workers from many different agencies (including housing, education, social work and justice). The first face-to-face forum was only held in October 2008, with the first year's results published at the end of 2009.(487) The Home Affairs Select Committee recently praised Scotland's Violence Reduction Unit's 'innovative' strategy in its report on knife crime (488).

Case study 2: Education-Related Parenting Contracts

The policy issue

Most people agree that parents need to be able to guide and nurture their children and discipline them when necessary. As part of this, parents are expected to support schools in making sure their children attend class regularly and behave appropriately whilst there. Accordingly, there is concern about truancy and poor behaviour in the classroom.(489) In the Autumn 2008 and Spring 2009 terms, unauthorised absence statistics show that 1.03% of the half day school sessions were missed without permission. In the 2007/8 academic year, there were 8,130 permanent exclusions from primary, secondary and special schools in England, which represents 0.11 percent of the number of pupils in schools. The most common reason for exclusion was persistent disruptive behaviour.(490)

Using commitment contracts to change behaviour

Education-related Parenting Contracts and Parenting Orders were introduced in February 2004 to promote and reinforce parental responsibility for school attendance and behaviour. An education-related Parenting Contract is a voluntary, written agreement between a parent and either the governing body of a school or a local authority. Parents cannot be compelled to enter into a Parenting Contract and there is no obligation for local authorities and schools to offer them. These agreements are designed specifically for the parent's individual needs, to best help them address their child's behaviour and/or attendance. The contract includes a statement and a commitment by the parents that they agree for a specified period of time to comply with the requirements set out in the agreement. Parents in many cases are encouraged to suggest their own solutions as to what measures would be most effective. The school or local authority provides a statement and similar commitment agreeing to provide support to the parents to improve the child's behaviour and/or attendance. Support ranges from the family being bought an alarm clock to parents being offered a place on parenting skills courses.

After the Parenting Contracts have been signed off, an initial period of time is usually given for the pupil's behaviour or attendance to improve. If there is little or no improvement then the period of the contract can be extended, with both sides' agreement. There is no sanction for a parent's failure to comply with or refusal to sign a Parenting Contract. However, if the pupil's misbehaviour or attendance continues or worsens and the school or local authority applies for a Parenting Order (a civil order), then the Court can take non compliance with the Contract into account when considering whether to grant an Order. In the case of poor school attendance the local authority may consider prosecuting the parent, but this should be the last resort.

Evaluation

In 2008, a DCSF-commissioned evaluation of education-related Parenting Contracts set out to assess their role in improving children's behaviour and reducing unauthorised attendance (491). For those schools and local authorities using them, the evaluation showed that there was a greater use of Parenting Contracts for attendance problems rather than for bad behaviour. The trigger for contracts due to poor attendance usually occurred when unauthorised absences dropped below a specific level. For bad behaviour, parenting contracts were often used as a last resort attempt when other interventions had failed.

Schools, local authorities and parents were generally positive about the role of Parental Contracts in reducing non-attendance and improving behaviour. The majority of schools involved in the evaluation saw attendance improve as a result of using these agreements. Although a fewer number of contracts were used for bad behaviour, it was considered very difficult to isolate their effectiveness, as a number of other interventions were often running concurrently. However schools and local authorities did feel that Parenting Contracts had helped to avoid the child in question being permanently excluded and that generally, their behaviour had improved.

Case study 3: Increasing recycling through deposit schemes

The policy issue

The United Kingdom consumed approximately 14 billion litres of soft drinks in 2007, equivalent to around 234 litres per person. In the same year nearly 24 billion beverage packaging units were sold. (492). Recycling rates of such products is markedly less in the United Kingdom compared to other countries in Western Europe (493). In Denmark, a combination of a bottle deposit scheme with a network of Reverse Vending Machines (RVMs) has seen return rates of 84% for cans, 93% for plastic bottles and 91% for glass bottles (494).

Using incentives and loss aversion to change behaviour

There is no doubt that better facilities have contributed to improved household recycling. One area where recycling rates remains poor, however, is in the recycling of products purchased 'on the go' (e.g. soft drinks containers). Deposit schemes are used in many countries to encourage people to return empty packaging. The basic principle of the scheme is that consumers pay an additional fee to the retailer when purchasing a bottle or associated packaging. The deposit is refunded when the consumer returns the empty packaging. In a recent survey, 82% of people in the United Kingdom polled, said they would support a scheme whereby at least five pence was included in the price of every drink container, with the deposit returned for recycling (495).

There are a couple of examples of incentive schemes that have been used in the United Kingdom to improve recycling rates. IrnBru, which is manufactured by AG Barr, is available in refundable glass bottles. Empty bottles can be returned to retailers, who provide either cash refunds or a credit voucher. The current deposit value is 30p, and an impressive 70% of bottles are returned for cleaning and reuse (496). Reverse Vending Machines (RVM's) are devices that accept empty

beverage containers and can return money to the user. RVMs vary in size and their price ranges from a few thousand pounds for smaller receptacles to tens of thousands of pounds for larger units that can handle many thousands of bottles a day. An organisation called Recoup have been involved in a number of trials of RVMs, including one in Milton Keynes. Initially no incentive was offered to encourage the public to recycle using the RVM but an incentive has recently been introduced. These voucher-based incentives have not been seen to cause a significant effect on recycling behaviour. Another scheme by The Body Shop offered its customers a 10% price reduction if they returned containers to the shop for refilling. The scheme was dropped because only 1% of shoppers were using it (494).

There may be a number of reasons why IrnBru and other bottle deposit schemes have been effective, whilst other programmes have been less so. Behavioural economics provides us with one potential answer- the phenomenon of loss aversion. Loss aversion is the theory that states that losses loom larger than corresponding gains and subsequently have a greater effect on preferences. It is likely that part of the success of deposit schemes lie in generating loss aversion in consumers. When customers hand over their deposit, loss aversion predicts that failure to return the bottle and collect the payment back will trigger a larger psychological cost than the monetary value of the incentive would suggest. For this reason deposit schemes may have a more powerful effect on consumer behaviour than simple incentives alone.

Evaluation

Environmental Resources Management Limited (ERM) were commissioned by DEFRA in 2008 to investigate whether a bottle deposit scheme should be introduced in the United Kingdom. The findings of the evaluation were that deposit schemes increase return rates in countries using them (often reaching rates of over 85%) and that they may also contribute to reductions in littering. ERM

summarised that whilst it is not disputed that a deposit scheme would increase recycling, alternative schemes may achieve similar or better results at less cost (494).

A subsequent report from DEFRA suggests that there is unlikely to be a national deposit scheme rolled out in England in the foreseeable future (497). Such a scheme may be seen elsewhere in the United Kingdom, however, and The Climate Change (Scotland) Bill contains powers to introduce deposit and return schemes (498). It may also be that retailers themselves take on the responsibility for establishing bottle deposit schemes, and both Sainsbury's and Tesco have already tried this in various guises.

Case study 4: Encouraging smoking cessation

The policy issue

Smoking is the main cause of premature death in the UK and is the primary reason for the gap in healthy life expectancy between rich and poor (499). A recent study suggested that smoking was responsible for 19% of all deaths in 2005 and imposed direct costs of £5.2 billion on the NHS (132).

The most recent figures state that 21% of the population of Great Britain aged 16 and over smoke. Cigarette smoking is lower among households classified as professional and managerial (15%) than among those classified as routine and manual (26%). Smoking is highest in the 20-24 age group(31%) and lowest in those aged 60 and over (12%) (130).

Using affect to change behaviour

The main barrier to changing behaviour is the highly addictive nature of tobacco use: a recent synthesis of expert judgements found that tobacco was considered to be the third most dependence-creating of 20 drugs studied (500). Addiction can override 'rational' knowledge of the dangers of smoking: research from the US suggests that approximately half of smokers 'want to quit each year', but more than 85% of those who try to quit on their own relapse (most within a week).(501) Attaching a strong negative emotion to an activity can be an effective way of countering psychological and physical dependence. This was the basis of the British Heart Foundation's 2004 'Give up before you clog up' campaign, funded by the Department of Health.

The campaign was based around revolting images of cigarettes filled with glutinous fat deposits. The main television advertisement featured friends talking and smoking in a bar: a realistic, familiar and attractive context for smoking. Any comfort that had been created soon turned to disgust as it became clear that the cigarettes were extruding viscous white fat, rather than ash. The friends,

oblivious, continue to chat, as the fat drops onto their clothes and runs down their fingers. One addresses the camera, explaining that smoking is hard to give up, but that 'makes this fatty stuff get stuck in our arteries'.

The scene cuts to a lab where gloved fingers are squeezing fat out of a flesh-coloured tube – this, we are told, is the amount of fat found in the arteries of a thirty-two year old man (502). There are two main reasons why this advert may change behaviour. On the one hand, the visual image is a very salient way of communicating the main information: that there is a causal link between smoking and the build-up of fat in arteries. Of course, many smokers know the risk and dangers, yet do not act to reduce them. This is partly because we tend to 'discount' future consequences: the damage caused by smoking seems far in the future, whereas the pleasure of a cigarette is immediate. We also are biased to be over-optimistic when assessing risks to our health ("it'll never happen to me").(503) The advertisement addresses the 'discounting' bias by explicitly linking the consequence (fat build-up) with the immediate pleasurable act (smoking); over-optimism is countered by presenting sympathetic smokers in a familiar, naturalistic environment, thus saliently connecting the repulsive fat with "people like me".

The advert aims to attach automatic, visceral disgust to cigarettes and smoking. The British Heart Foundation actually made this aim explicit when commenting on a related poster (showing a cigarette as a fat-filled artery), saying that they wished to "develop a Pavlovian response between the cigarette and the gunk-filled artery so that as soon as a smoker sees a cigarette they will be reminded of the clogged artery' (504). It may be that smokers do not remember the clogged artery, but only the disgust that has been linked with cigarettes. Automatic emotional responses, such as disgust, can be very powerful and can be 'learnt' – many people have experienced the powerful need to wash their hands after activities that are considered unclean (505).

Evaluation

The initial phase of the campaign, featuring the 'fatty cigarette' advert, was funded by £4 million from the Department of Health. In addition to the television advert, the campaign covered newspaper, poster and online advertising throughout January as well as beer mats distributed in pubs across England. These mostly featured a cigarette as a fat-filled artery. The campaign was targeted at 'multi-quitters' (smokers who had made at least 3 attempts to quit, one in the previous year) in C1C2D categories. Awareness of the campaign was evaluated after the various phases in 2004 (506).

It was considered that the visceral and disgusting quality of the fatty cigarette did achieve the 'iconic' status that was demanded of it'. 20% of respondents agreed with the statement 'It made me think about it every time I pick up a cigarette' (506). It is worth remembering that those questioned were 'multi-quitters', who are likely to have particularly strong dependencies.

In terms of changing behaviour, actual and intended quit attempts amongst NHS Stop Smoking Services increased significantly in January-March 2004, the phase where the television advert was featured heavily (506).

There are, of course, difficulties in associating this rise with the 'fatty cigarette' advert alone, since the advert only formed part of a wider multi-media campaign. Indeed, the graph above shows there is a strong seasonality effect to quitting smoking, although the fatty cigarettes did provoke a considerably larger drop than in previous years. It is also difficult to establish whether a campaign that focused less on creating an emotional response would have been less effective – although there is qualitative evidence that disgust played a large part in the decision of those who did quit (507).

Case study 5: Increasing contraceptive use

The policy issue

There are currently more than 33 million people living with HIV globally. Sub-Saharan Africa remains the region most heavily affected by HIV worldwide, accounting for over two thirds (67%) of all people living with HIV and for nearly three quarters (72%) of AIDS-related deaths in 2008. Women are significantly more likely to contract HIV: in throughout the region, women account for 60% of all HIV infections.(508) HIV clearly has important consequences for those infected and for wider society in terms of carer burden, lost output etc. In an attempt to stem the epidemic, DfID has committed £6 billion over seven years to 2015 to improving health systems in developing countries. (509)

As the UK's AIDS strategy for developing countries notes: 'Successful HIV prevention is about enabling individuals, couples and communities to make healthy choices about personal aspects of their lives – particularly sexual behaviour. These are not just based on information and rational choice; they are also influenced by complicated drivers of human action, including gender roles, inequality, norms around sexuality...'(510). A key plank of the strategy is increasing awareness and use of condoms. But DfID has also recognised the need to incorporate the 'complicated drivers' around how we deal with information – in particular, the importance we attach to the messenger.

The weight we give to information depends greatly on the feelings and thoughts we have about its source. This principle is the foundation of the DfID-funded 'Get Braids Not Aids' campaign in Zimbabwe, which is one of the countries that has been worst hit by the virus (In 2001, shortly before the programme commenced, HIV prevalence in the general population was estimated to be 26.5%. UNGASS (2008) Zimbabwe Country Report, p.4.) The scheme trains hairdressers in low-income areas in informing their clients of the benefits of female condoms, how they are used and how to introduce them into a relationship.(511) This means the information is being provided by a

familiar person in a friendly, supportive and safe environment, which helps overcome the stigma attached to female condoms and means the women feel freer to talk about their personal issues. Also, associating female condoms with a friendly person or enjoyable experience may lead them to be perceived in a more positive light as a whole (this type of cognitive bias is known as the 'halo effect'.(512)

Evaluation

By 2005, 'Get Braids Not Aids' had a network of 1,000 hair dressers in 500 salons, which sold 450,000 female condoms.(511) This represented over half of total sales of female condoms in Zimbabwe, which have increased dramatically since 1997.(513) A DfID-funded study amongst 400 hair salon clients found that women who had seen a female condom demonstration by a hairdresser were 2.5 times more likely to use the product than those who had not.(514)

The study found that 28% of respondents reported using the female condom (called Care), compared to only 15% in 2002. 35% of respondents spontaneously reported hair salons as a source of information about Care, while 47% said they had specifically talked about Care with their hairdresser. There are questions, however, over the sustained use of female condoms, since it appears that half of the women who purchased the female condom only used it once.

Given the various complicating factors, it is not possible to draw a causal link between this programme and AIDS prevalence. However, a recent United Nations report attributes the significant decline in HIV prevalence in the last decade to mortality and 'a decline in HIV incidence due to behaviour change'(515).

Case study 6: An 'opt-out' system for private pensions

The policy issue

As the Pensions Commission made clear, the current system of pensions is insufficient and 'will deliver increasingly inadequate and unequal results'. Not only are private pension contributions failing to rise as expected, but increasing life expectancy will create pressures that cannot be alleviated by raising the pensionable age alone (516). There are currently around 7 million people in the UK who are not saving enough to generate the income they are likely to want in retirement (13).

Using defaults to change behaviour

The Commission pointed out that 'initiatives to stimulate personal pension saving have not worked', and pointed to 'the limited impact of providing better information and generic advice'.(13) Indeed, in 2003 an estimated 4.6 million employees had not joined employer-based pension seems to which they had access (517). Strictly speaking, this failure is irrational, since joining such a scheme would bring considerable benefits to these employees.

There are many reasons for the low level of pension saving. Joining a scheme requires an active decision, but people often display inertia when confronted with such decisions. For example, many banks and credit cards tempt people to open accounts with attractive introductory offers, knowing that they will fail to move even when these offers elapse (this is known as 'status quo bias' (518). The problem is especially acute for pensions because they deal with a far-off future scenario: since people find it difficult to imagine the misery of penurious old age, the decision to act does not seem to be a high priority and apparently can always be deferred (70). Finally, people are more likely to defer decisions that are complex and confusing, and thus require significant mental effort – like selecting a pension scheme.

Information provision alone fails because people may not act on this information, for all the reasons given. In the words of one interviewee, ‘we know we should be contributing to a pension plan, but it’s never the right day to start’- This is analogous to the model developed by Becker for rational addiction (519). In such a situation, should government just compel people to save more? The Pensions Commission noted that ‘while many people say they want to “have to save”, many respond adversely to the idea of compulsory savings’ (516). How, then, should government take stronger action without removing freedom? The answer from behavioural economics: use people’s inertia to actually encourage saving.

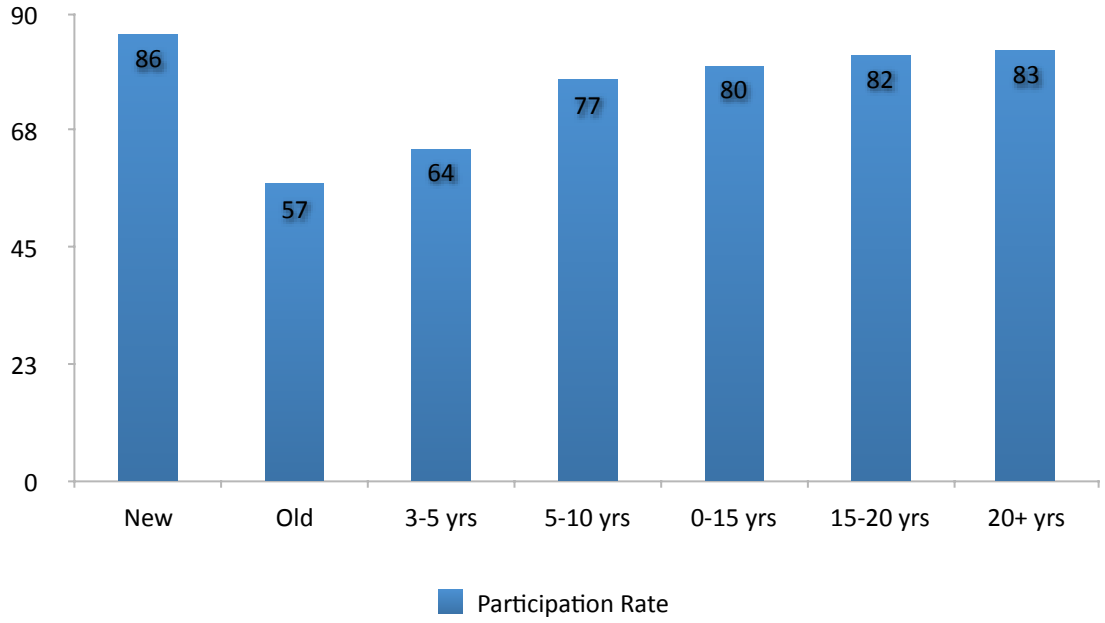
Currently, the onus is almost always on employees to make the effort to join their company’s pension plan or buy a personal pension. In other words, the ‘default’ option when employees join a company is for them not to join. The concept adopted by the Pensions Commission was to change this default: employees would automatically join the pension plan, but still have the opportunity to opt-out if they wish. Changing the default means that inertia is now working in favour of savings – but preserving an opt-out means that the government avoids introducing a compulsory saving system. The reform also introduces a compulsory “matching” contribution from the employer, obliging them to contribute to an employee’s pension (unless the employee opts out).

It is an attractive position that has been labelled ‘libertarian paternalism’ (4). Indeed, one interviewee explained that having a simple and intuitive governing concept like ‘changing the default’ has helped maintain focus and momentum during the long process of implementing the Commission’s findings. Nevertheless, having a compelling theory alone is rarely enough when creating policy; a crucial factor in gaining support for an opt-out default was the compelling evidence of its effects in real life.

To take one of many examples, a study assessed the changes in pension uptake when a large US corporation switched their default from active to automatic enrolment. As the graph below shows,

enrolment increased significantly after the change in default (520). Interestingly, introducing automatic enrolment also eliminated most of the previous differences in participation due to income, sex, job tenure and race – the increase in take-up was particularly large for low and medium income workers.

This figure charts pension participation rate by years worked in the company. For employees hired prior to automatic enrolment, participation increases with tenure. But the highest participation rates are for the employees hired under automatic enrolment.



As well as sound theory and strong evidence, the movement to joining by default, with an opt-out, was aided by support from stakeholders: for example, pension providers can gain business and cut marketing costs, while small businesses' pension contributions are in line with their employees' desire to save. As a consequence, the Pensions Act 2008 requires employers to automatically enrol all eligible workers over the age of 22 into the relevant workplace pension (with minimum total contributions of 8% of salary) from 2012.(13)

Evaluation

Naturally, an evaluation of this policy does not exist as this change in the default does not come into force until 2012. Nevertheless, the practical steps of translating an interesting concept into practice are worth reflecting on. Changing default settings may be easy on a small scale and in informal contexts, but there are challenges when national governments are required to legislate:

The power of inertia means that the nature of the default pension fund needs to be chosen very carefully. As a result, the Personal Account Development Authority has just consulted on developing guidelines that will be used as investment principles for the fund managers of the proposed National Employment Savings Trust.(92)

The use of legislation to compel employer contributions means that the Pensions Regulator will need to take on considerable new powers to ensure employers are complying with the new arrangements. Finally, the setup needs to reflect the motivations of the different parties. For example, the question of who provides the opt-out (i.e. who the messenger is) needs to recognise that employers may have an incentive to encourage employees to opt out.

Changing defaults is seen as a relatively cheap way of encouraging beneficial behaviours. Of course, this depends on a) costs associated with the actual change of the default; and b) the costs arising from more people choosing the new default option. In terms of changing the default, the DWP has estimated there will be a one-off transition cost of £0.3 billion. The average monetised costs and benefits of people choosing the new default are roughly equal at approximately £15 billion a year, although they accrue to different parties (combined individual and employer contributions are offset by £15 billion of higher income for individuals in retirement). However, the DWP believes that there will be additional non-monetised benefits of £40 billion of social welfare benefit over 43 years (as a result of smoothing citizens' income over their lifetime), as well as a long-term increase in UK incomes due to additional savings.

Appendix 2: Applying Mindspace to the problem of teenage pregnancy

In the Mindspace report I explored how a local authority could explore and meet the challenges of teenage pregnancy, using the 6 E's framework.

A local authority has identified that it has unusually high rates, compared with comparable areas, of both teenage pregnancies and STDs. They have been set a challenging LAA target for National Indicator 112 (PSA 24) 'Under 18 Conception Rate', but their performance indicators are not moving. How can MINDSPACE offer a new approach?

Explore

The Local Authority brings together key figures from the PCT, local schools and the local community to assess levels of interest and current local strategies. This starts to identify ideas about what might be going wrong in the local area, and establishes common interests and resources to explore the issue further.

Insight research is commissioned locally involving focus groups and some one-to-one interviews (given the personal nature of the subject). This research explores the thoughts, feelings and pressures on teenagers (including teenage parents) and their parents. Evidence is also drawn from the new 'What works?' data bank of previous evaluations and international evidence funded by several large central government departments.

Insight found that one of the weaknesses of information and leaflets was that it concentrated on facts and figures about sex and STDs rather than the more potent influences on behaviour such as self-image and social pressure (Ego and Norms). For example, young people often felt unsure about how widespread sexual activity was, and those who were engaging in early sex felt uncomfortable about the reaction of their partner if they insisted on contraception, since it might imply they were

already promiscuous or that it somehow implied they didn't trust their partner. It was also found that many young people did not relate to national-level statistics and figures.

Ironically, the local practice of having previous teenage parents come and talk to children in schools about why they regretted getting pregnant so young was found to have the exact reverse effect on many young people. It helped them imagine themselves in that situation (Salience), made it seem more normal (Norms), and the young mothers themselves seemed rather impressive and grown-up (Messenger).

Finally, it turned out that a major driver of early sexual activity, and indeed lower educational attainment and behavioural problems in the classroom, turned out be rooted in self-image. Many young people felt caught in a frustrating dynamic of „being treated like a child at home and school", and, in a slightly jumbled way, felt that sex was a route to being respected and treated as an adult (Ego).

Enable

For the most part, lack of information about safe sex was not fund to be a major barrier, but there was evidence that there were some specific gaps in knowledge, such as some practical aspects of birth control use and a lack of understanding of the long-term effects of certain STDs. Sex guidance and information was therefore updated. Supply of contraception, including the cost of condoms, was a barrier in some at-risk younger groups, and dispensers were added in school toilets – within cubicles rather than more public areas to avoid unwanted social pressure.

Encourage

Salience and Norms

Recognising the importance of self-esteem rather than facts, leaflets and classes were changed to focus much more heavily on how other people, including peers and the other sex, felt about birth

control. In order to make statistics more Salient, 2 Discussion document – not a statement of government policy a local survey of relationships and sexual behaviours was organised by parents and a local school nurse. Students found the results from the local survey far more salient, and it also served to break the taboo of younger age sex and relationships. Many young people were surprised to find out that far fewer of their peers were having sex than they thought, which they felt removed pressure on them (Norms).

Messenger

Schools also took a new approach to visits: rather than inviting just teenage mothers in to talk, they set up a panel of five former pupils to talk about their lives and relationships. Just like the teenage parents, they were articulate and impressive – but, of course, most of those who left school were not teenage parents. A typical panel of 20-something ex-students had three who were not parents, of whom one was recently married, one was in a long-term relationship, and one who had recently broken up. The fourth was also recently married and had just had a child. The fifth, on some of the panels, had been a teen parent. In other words, various „alternative futures" were made Salient, while it was clear that the dominant Norm was not being a single mother.

Commitment

Some schools and parents experimented with „compacts" – students would actually make a pledge with themselves as part of PHSE classes that, if they were in a relationship, they would agree with their partner to use birth control (Commitment). Though some felt these „compacts" were embarrassing, many subsequently felt that they were glad that they had done so.

Engage

Many of the elements of the Borough"s programme on teenage sexual behaviour were controversial. Engaging with parents, professional and children was an important part of getting

permission for the programme. The local authority had to stress the scale of the problem in the area (although not to teenagers, to prevent an undesirable social norm), and the difficulties that can ensue from teenage pregnancy. The engagement itself helped to raise the profile of the issue and increased the acceptability of talking about sex and relationships in the area, thereby creating a self-reinforcing social norm.

Exemplify

In this instance, the local authority recognised that it would find it difficult to exemplify actions that lead to lower teenage pregnancy. Therefore, it mostly restricted its activities to ensuring that it was giving a consistent message on the desirability of teenage pregnancy in all its areas of activity. In terms of policymaking, it was recognised that the Commitment to reach a certain LAA target had encouraged the local authority to think differently. In addition, a local health worker gave a hard hitting presentation to the local authority‟s team on the real emotion and social problems teenage pregnancy was creating in the local area (Salience and Affect). As a result, the Default approach to information provision had been shifted from neutrality to socially situated – unless decided otherwise, all information would be geared towards affecting self-esteem issues and social pressures felt by teenagers.

Evaluate

There were various elements to the programmes that were tried in the area. Schools and communities tended to use slightly different combinations. The evaluation used this variation, or tapestry, of interventions to test the relative efficacy of different aspects of the programme. Outcome variables included levels of STDs, teen pregnancy rates, and a repeat of the local survey on sexual behaviours

Appendix 3: IDEAS Project

Appendix 3.1: Comparison of design features of different charts used across the UK NHS (n=15)

	Ch 1	Ch 2	Ch 3	Ch4	Ch 5	Ch 6	CH7	Ch 8	Ch 9	Ch1 0	Ch 11	Ch12	Ch1 3	Ch1 4	Ch15	**IDEAS**
Format	B	B	B	B	F	B	F	B	B	F	B	B	F	F	B	**B**
Cut out	N	N	Y	Y	N	Y	N	N	Y	N	N	N	Y	N	Y	**Y**
No of pages	12	12	12	12	6	6	6	12	12	8	12	12	8	6	8	**16**
Background Colour	V	W	W	B	W	W	W	W	B	W	P	B	W	Y	W	**B**
Height/ Weight/BSA	YYY	YYY	YYY	YYY	NNN	YYY	YYY	NNN	YYY	YYY	YYY	YYN	YNN	N	YYN	**YYY**
Separate section for allergy reaction	Y	N	Y	N	N	Y	Y	Y	Y	N	N	YYN	N	N	Y	**Y**
Reconciliation Y/N (Number)	N	Y (one box)	Y	Y	N	N	N	Y	Y	Y	Y	N	Y	Y	Y	**Y**
Once only capacity	31	25	23	16	14	10	12	8	12	12	11	12	7	7	8	**10**
Variable Dose Capacity	0	0	12	2	2	0	0	2	0	3	2	2	2	0	2	**2**
Regular medication capacity	32	21	16	18	14	11	20	24	22	12	12	25	17	12	25	**29**
Fluid units capacity	0	0	51	30	0	0	9	0	19	20	27	0	24	20	20	**40**
PRN medication capacity	6	12	12	7	6	7	7	12	14	7	6	10	7	6	10	**10**

Section for warfarin	N	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	N	0	**Y**
Section for oxygen	Y	Y	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	N	N	**Y**
Section for antibiotics	N	Y	N	N	N	N	N	N	Y	N	Y	Y	N	N	N	**Y**
Section for MAWP	N	Y	N	Y	N	N	Y	Y	N	N	N	N	N	N	N	**N**
Section for omissions	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	N	Y	**Y**
Section for LMWH	Y	N	N	Y	N	Y	N	Y	Y	Y	N	Y	Y	N	N	**Y**
Dispensing days (regular)	14	14	14	14	14	14	13	14	14	14	14	14	12	14	14	**14**
Dispensing options (PRN)	12	18	14	16	14	14	15	14	12	16	13	11	14	14	33	**15**
Format (b - book, f - foldout), Colour (v - variable, w - white, p - pink, b - blue)																

Appendix 3.2: Analysis of completed prescription charts in patients who were consecutively discharged from one medical and one surgical ward at a London hospital (n=40)

Detail	Percentage Completed	No of Entries
Basic Patient Details		
Patient name (n=40)	40 (100%)	
Patient DoB (n=40)	40 (100%)	
Hospital number (n=40)	40 (100%)	
NHS Number (n=40)	1 (2.5%)	
Weight (n=40)	10 (25%)	
Height (n=40)	5 (12.5%)	
Body Surface Area (n=40)	1 (2.5%)	
Use of addressograph label (n=40)	15 (37.5%)	
Hospital Details		
Ward (n=40)	36 (90%)	
Consultant (n=40)	27 (67.5%)	
Junior doctor (n=40)	2 (5%)	
Bleep number (n=40)	5 (12.5%)	
TTA written (n=40)	11 (27.5%)	
EDC screened (n=40)	10 (25%)	
Chart number (n=40)	15 (37.5%)	
Pharmacy cost centre (n=40)	4 (10%)	
Medication on supplementary chart (n=40)	0 (0%)	
Allergies		
No of patients with documented allergies (n=40)	10 (25%)	
Number of allergies where reaction was documented (n=10)	3 (30% of total)	
Once Only Medication		
Number of charts with > 0 entries (n=40)	26 (65%)	

Median number of entries		1.5 (range 0 - 9)
Preparations administered by nurse		
Number of charts with > 0 entries (n=40)	0 (0%)	
Median number of entries		0
Medicines Reconciliation		
Number of charts with > 0 entries (n=40)	30 (75%)	
Source of medication history detailed (n=40)	31 (77.5%	
Checked by pharmacist checked (n=40)	30 (75%)	
Multidisciplinary communication box used (n=40)	13 (32.5%)	
VTE Assessment		
Risk assessment fully completed (n=40)	0 (0%)	
Eligibility for prophylaxis confirmed (n=40)	4 (10%)	
Doctor completing assessment recognisable (n=40)	4 (10%)	
Anti-embolism stockings prescribed (n=40)	12 (30%)	
LMWH prescribed (n=40)	29 (72.5%)	
Warfarin prescribed (n=40)	0 (0%)	
Variable Dose Prescriptions		
Number of charts with > 0 entries (n=40)	6 (15%)	
Regular Medications		
Number of charts with > 0 entries (n=40)	100 (100%)	
Total number of individual prescriptions on 40 drug charts - 350		
Longest prescription (characters) - 24		
Median number of entries		8 (0 - 20)
Legible (n=350)	328 (93.7%)	
Units written in full (n=350)	262 (74.9%)	
Start date documented (n=350)	344 (98.9%)	

Stop date documented (n=350)	4 (1.14%)	
Identify prescriber (n=350)	37 (10.6%)	
Completed whether new or continued medication (n=350)	213 (60.9%)	
Antibiotics		
Number of patients who received antibiotics (n=40)	18 (45%)	
Total number of prescriptions (n=40)		
Documented duration (n=40 prescriptions)	8 (20%)	
Documented indication (n=40 prescriptions)	21 (52.5%)	
As Required Medications		
Number of charts with > 0 entries (n=40)	32 (80%)	
Total number of prescriptions (n=101)		
Number Median number of entries		2 (0 - 7)
Number legible (n=101)	91 (90.1%)	
Units written in full (n=101)	65 (64.4%)	
Start date documented (n=101)	99 (98%)	
Identify prescriber (n=101)	9 (0.089%)	
Completed whether new or continued medication (n=101)	9 (0.089%)	
Oxygen Prescription		
Number of charts with > 0 entries (n=40)	0 (0%)	
I**nsulin Prescription**		
Number of charts with > 0 entries (n=40)	0 (0%)	
Infusions		
Number of charts with > 0 entries (n=40)	23 (57.5%)	
Median number of entries		2 (0 - 7)
Medicines not administered		
Number of charts with > 0 entries (n=40)	7 (17.5%)	

Appendix 3.3: Findings from focus groups (selected statements)

Size of charts and ordering Group 1, male doctor: 'I agree it is much nicer (having a larger chart). it is such a pain re-writing drug charts' Group 1, male pharmacist: 'if someone's on HIV meds and they are on the front of the front, it's a bit less confidential' Group 2, female doctor: 'I think the (reconciliation' section is really good. I think we (doctors) find it very useful' Group 2, female doctor: 'An index isn't so important for us (junior doctor's who use the chart all the time, but I can understand it for a consultant... who doesn't see them all the time.. and wants to find something quickly Group 2, female pharmacist: 'the one thing that is clear is that (sections) shouldn't be physically set apart. It has to attached into a booklet because otherwise (sections) will get lost
Incomplete prescriptions Group 1, male pharmacist: 'maybe thats part of the problem, that someone else is going to fill it in' Group 1, male pharmacist: 'drugs will get given even if the drugs aren't signed for. i don't think I have ever seen a drug not given because the prescription has not been signed' Group 1, female doctor: 'I definitely feel more secure that I know the pharmacist is going to check it (my prescription)... but there is that feeling that there is a safety net'
Factors behind poor prescribing Group 1, female nurse: 'once they finish a ward round the doctors come back to the ward and write them properly. Thats our ward practice' Group 1, male doctor: 'there is no chance really, of anybody going onto the internet, finding the policy, finding the right page and copying it out'

Methods to facilitate good prescribing

Group 1, female nurse: ‘house officers.. are not used to the scales (sliding scales for insulin’ there should be space on the chart where the proper scale can be entered’

Group 1, male pharmacist: ‘the standardisation of some of this stuff I think is a good thing

Group 2, female doctor: ‘I really like the idea of tick boxes... and I like the fact that you don’t have to write the frequency but rather circle it.

Group 2, female doctor: ‘my only concern (with the checked boxes) is that people... who have illegible handwriting.. will ignore these boxes and write over them’

Appendix 3.4: Case study used in phase 3 of the simulation study

Imperial Drug Chart Evaluation and Adoption Study (IDEAS) - Simulation Study

Please read the following case study and complete the instructions

Background Information

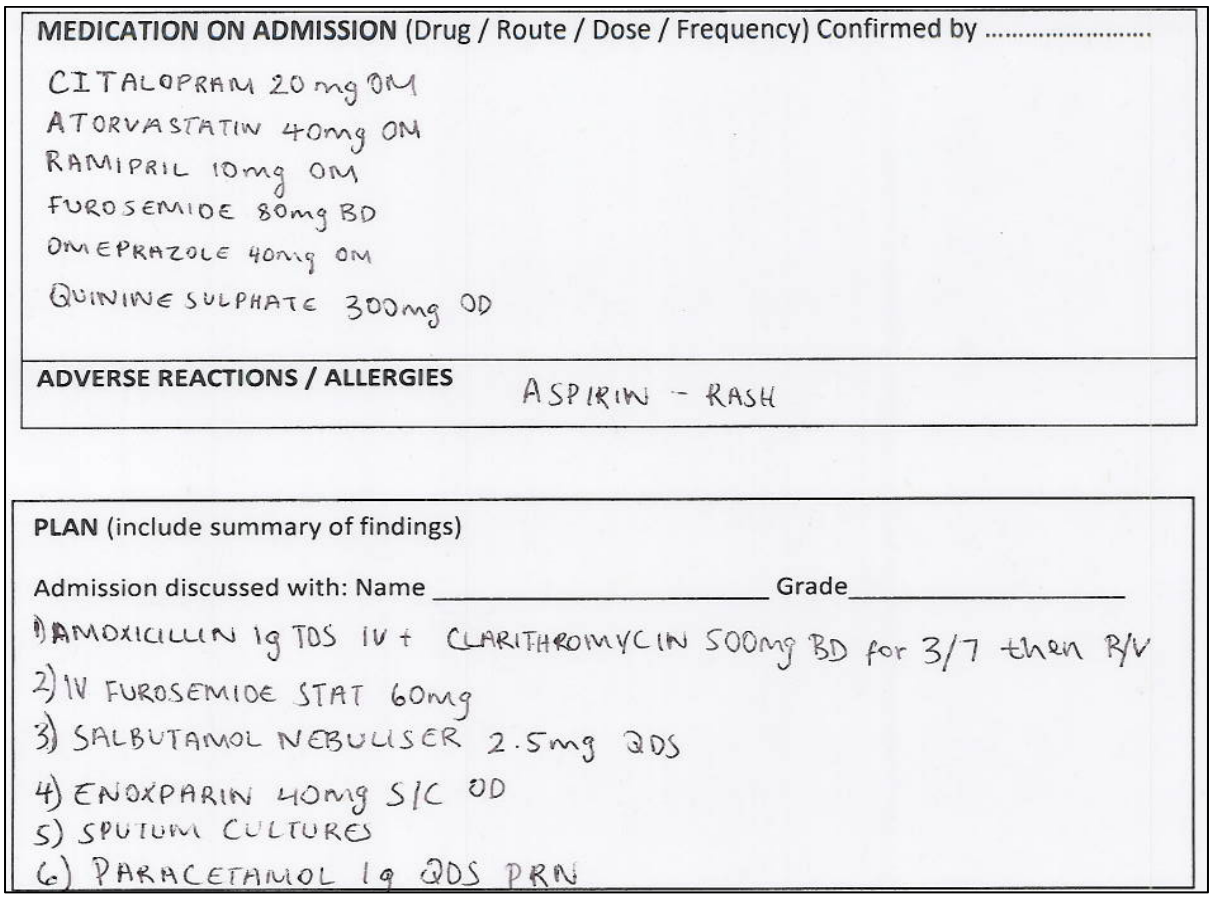
A 62 year old lady Mary Brown (Dob: 01/07/45 Hospital No: 1564376M NHS No: 12768674) presents today with hospital acquired pneumonia and heart failure to the emergency department. Mrs Brown is 162cm tall and weighs 58kg. Mary is allergic to aspirin which has previously caused her to have a widespread rash. Mary has hypertension, depression, ischaemic heart disease, gastritis and peripheral vascular disease affecting her legs and she often suffers from cramps. She has no contraindications to heparin prophylaxis. Following a clinical examination and a review of her initial investigations, she admitted to the Battle Ward under Dr James, the respiratory consultant.

PRESCRIBER: Please prescribe:

- **ALL** the usual medication for the patient, together with the planned intravenous medicines (amoxicillin 1g TDS IV, clarithromycin 500mg BD IV, furosemide 60mg STAT IV) and nebuliser (salbutamol nebuliser 2.5mg QDS).
- **In addition**, please prescribe 40mg enoxaparin S/C OD at 6pm for DVT prophylaxis.
- **Also,** please prescribe 1g paracetamol for analgesic when required.

PHARMACIST: Please screen the chart assuming none of the patient's usual medicines are ward stock, but that those referred to in the treatment plan **are** stock. Assume that the medication history and allergy status are correct. The patient is admitted to a one-stop dispensing ward.

NURSE: Please sign on the chart for all the medication as if you were carrying out the morning (8am) medication round on the ward. This is a simulation study and no medicines need be prepared or administered.



MEDICATION ON ADMISSION (Drug / Route / Dose / Frequency) Confirmed by .....

CITALOPRAM 20 mg OM
ATORVASTATIN 40mg OM
RAMIPRIL 10mg OM
FUROSEMIDE 80mg BD
OMEPRAZOLE 40mg OM
QUININE SULPHATE 300mg OD

ADVERSE REACTIONS / ALLERGIES ASPIRIN - RASH

PLAN (include summary of findings)

Admission discussed with: Name _____ Grade_____

1) AMOXICILLIN 1g TDS IV + CLARITHROMYCIN 500mg BD for 3/7 then P/V
2) IV FUROSEMIDE STAT 60mg
3) SALBUTAMOL NEBULISER 2.5mg QDS
4) ENOXPARIN 40mg S/C OD
5) SPUTUM CULTURES
6) PARACETAMOL 1g QDS PRN