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What is really 'behavioral' in behavioral health policy? And does it work?

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Abstract. Across health systems, there is an increasing interest in applying behavioral economics insights to health policy challenges. Policy decision-makers have recently discussed a range of diverse health policy interventions that are commonly brought together under a 'behavioral' umbrella. These include, among others: randomized controlled trials, comparison portals, information labels, financial incentives, sin taxes, and nudges. A taxonomy is proposed to classify such 'behavioral' interventions. In the context of risky health behavior, each cluster of policies is then scrutinized under two respects: i) What are its genuinely 'behavioral' insights? ii) What evidence does exist on its practical effectiveness? The discussion highlights the main challenges in drawing a clear mapping between how much each policy is 'behaviorally' inspired and its effectiveness.

1. Introduction

In the last six years, almost in concurrence with the global economic and financial crisis, few words have been more frequently used in the policy-making arena than '*behavioral*'. Google statistics, for instance, show that the search interest index for the expression '*behavioral policy*' have suddenly ramped from 0 to 83 in February 2007, and reached its apex in January 2013.

'*Behavioral economics*', and more generally '*applied behavioral science*' (Kahneman, 2013) have indeed gained momentum among decision-makers in the public sector. Several governments have constituted '*behavioral insights teams*' within their civil services, to inform public decision-making: from the so-called '*Nudge Unit*' in the UK Cabinet Office, to the Office for Information and Regulatory Affairs and now the Social and Behavioral Sciences Team in the Obama administration; to analogous initiatives within the European Commission (e.g. DG SANCO), and the governments of Denmark, France, the Netherlands, and Sweden (Dolan et al., 2012; Sunstein, 2011).

Two recent books have systematically discussed the applications of 'behavioral' insights to public policy (Shafir, 2012; Oliver, 2013), and a number of articles have explored specific areas of applications, spanning from savings and pensions to welfare (Thaler and Benartzi, 2004; Bernheim and Rangel, 2007; Beshears et al., 2011; Costa-Font, 2011). Most notably, there has been a growing discussion on how to apply behavioral economics to policy decisions in the health context (Loewenstein, Brennan, and Volpp, 2007; Volpp et al., 2011; Loewenstein et al., 2012).

Policy-makers have indeed put forward an array of, often referred as, 'behavioral health policies' in the attempt to deal with some of the current challenges in OECD societies: from aging and the need for longer and more comprehensive private health insurance schemes, to the chronic diseases epidemics related to risky behaviors, such as smoking, over-eating and unhealthy diet.

The health policy interventions that go under this ‘behavioral’ umbrella are, in fact, quite numerous and diverse: just to name some: portals and websites comparing menus of health insurance contracts; incentives to quit smoking or lose weight; nutritional information labels on food items; ‘randomized control trials’; relocating snacks and fruits in a cafeteria or vending machine; introducing taxes on fizzy drinks.

The present work is motivated by the observation that, among practitioners, these health policies seem often to be indiscriminately grouped together under the ‘behavioral’ umbrella in a quite interchangeable way. Among practitioners and researchers, moreover, there is some debate on what is really ‘behavioral’ in each of these ‘behavioral health policies’.

There are, in particular, two, related, areas of potential dispute. First, it is unclear whether the ‘behavioral’ attribute refers to either the methods or the insights (or both). Second, the question is often made of how closely the conceptual core of these disparate policies is inspired to genuine ‘behavioral’ insights.

There is, moreover, an important, overarching, empirical question, and is related to whether or not these ‘behavioral’ health policies really work in practice.

In this work we attempt to dissect the two areas of debate by directly linking them to this empirical question. By proposing a clear categorization of the ‘behavioral’ contribution of each health policy, and by mapping each category with the available evidence on its effectiveness, we aim to help practitioners and decision-makers to openly identify what works and what does not within each category of ‘behavioral’ interventions.

We start with an operational definition of ‘behavioral’ policy and, ultimately, of ‘behavioral’ economics as opposed to ‘conventional’ economics. In order to deal with the two areas of possible debate, we immediately make the distinction between insights and methods, and then focus on the nature and content - rather than methodology - of the ‘behavioral’ policies.

We proceed by proposing a taxonomy of five different ‘clusters’ of health policy interventions: preferences-based policies; information-based policies; financial incentives; tax- and subsidy-based policies; and nudges.

We then discuss to which extent these five clusters of ‘behavioral’ policies can be considered to move away from the ‘conventional’ economics view of individual behavior and decision-making. We review the typical arguments that some of these policies have in fact limited ‘behavioral’ content, and are instead quite well established tools in the ‘conventional’ economics toolkit.

We then focus on reviewing the existing evidence on whether the different policies lead to significant and sustained changes in health behavior. Although other examples are considered, the (unsystematic) review focuses on health policies targeting risky health behaviors, mainly unhealthy and excess eating, and insufficient physical exercise.

By doing so we attempt to draw a mapping between the perspective under which the health policy can be considered ‘behavioral’ and its effectiveness. The main conclusions are that: i) in general, and especially for some clusters, we need more evidence on policy effectiveness; ii) policies that are directly inspired to ‘behavioral’ insights tend to effectively lead to sustained behavioral change and successfully deal with ‘internalities’; iii) policies such as taxes and subsidies that are closer, in their conception, to ‘conventional’ economics can effectively deal with ‘externalities’; iv) the debate on what is really ‘behavioral’ in each health policy cluster is perhaps off-the-mark: policy attention should focus on openly testing and assessing what really works in changing health behaviors and fine-tuning interventions accordingly; v) the use of a broad spectrum of randomized controlled experiments spanning from the lab to the field should be welcome to such a purpose.

The rest of the article is structured as follows. In Section 2 we define ‘behavioral’ policy and economics. Section 3 deals with the question of ‘behavioral’ methods and insights. Section 4 reviews the evidence on: (4.1) preferences-based policies; (4.2) information-based policies; (4.3) financial incentives; (4.4) tax- and subsidy-based policies; and (4.5) nudges. Finally, a discussion in Section 5 briefly concludes.

2. Setting the scene: an operational definition for ‘behavioral’ policy.

We start proposing an operational definition of ‘*behavioral policy*’ (or, equivalently, ‘*behavioral public policy*’). Following suit the recent contributions in this area (Kahneman, 2013; Oliver, 2013; Shafir, 2013), it is rather straightforward to define ‘behavioral policy’ as a set of policy interventions that is directly inspired to, and designed on, the principles of ‘behavioral’ research. More than one option is possible, however, on the precise disciplinary ‘label’ to be attached to such ‘behavioral’ research.

As a tentative approximation, behavioral researchers are essentially social and cognitive psychologists, as well as a ‘*growing minority of economists - behavioral economists*’ (Kahneman, 2013, p. ix). Daniel Kahneman proposes ‘*applied behavioral science*’ as a common ‘label’ for the shared activities, methods, and interests by psychologists and behavioral economists, and we find his definition the most fitting and comprehensive (Kahneman, 2013).

It is fair to notice, however, that in the popular press, as well as among most practitioners, findings and insights from applied behavioral science are often referred to as ‘*behavioral economics*’. This, in turn, naturally shifts the focus to an operational definition of ‘behavioral economics’.

To define ‘behavioral economics’ we use a definition provided by the influential *Round Table for Behavioral Economics* established in 1992 by the *Russell Sage Foundation*. This is arguably the first and best-known panel of world-leading scholars in applied behavioral science, and it has been invited by the Foundation to ‘*support to* *devise activities design to advance the new interdisciplinary field*' of 'behavioral economics' that the Foundation has been funding since 1986.

The *Round Table* defines 'behavioral economics' as follows: '*Behavioral economics uses facts, models, and methods from neighboring sciences to establish descriptively accurate findings about human cognitive ability and social interaction and to explore the implications of these findings for economic behavior. The most fertile neighboring science in recent decades has been psychology, but sociology, anthropology, biology, and other fields can usefully influence economics as well*' (Russell Sage Foundation, 2013).

In essence behavioral economics is thus defined as the application to 'conventional' economics of insights from cognitive and social psychology, as well as of cognate disciplines, to improve the understanding of economic behavior and decision-making.

This definition implicitly defines 'behavioral' economics as departing from, and challenging, the traditional view of 'conventional' economics. To help highlighting the distinction between 'behavioral' and 'conventional' economics, a definition of the latter may be helpful.

In a nutshell, conventional economics is essentially based on the assumption of perfectly '*rational individuals who engage in maximizing behavior*' (Lazear, 2000). In its most stylized and popularized form, the conventional economics view relies on four main conceptual 'pillars' and posits that:

1. We have a complete and comprehensive set of preferences - spanning over all possible factors affecting our utility and wellbeing - and a clear, conscious, and consistent representation of those preferences: our preferences are thus stable both across domains/situations, and over time;
2. These preferences drive our behavior and decision-making: when we decide, we process all available information, we rationally calculate the costs and benefits of different choices or courses of actions, and deliberately pick the one that most closely matches our preferences;
3. Our rational decisions and behavior best serve our own interests and maximize our own utility when interacting with others in markets: markets aggregate individual costs/benefits values and translate into prices;
4. Since we always rationally act in our own best interests, public intervention is needed only when markets fail to correctly translate some costs/benefits values into prices: this typically occurs in the case of market failures such as 'externalities' where individual values do not incorporate effects on others' costs or benefits.

'Conventional' economics approaches essentially stick to these four conceptual pillars, while 'behavioral' economics relaxes some of these assumptions in light of the evidence suggesting that, for instance, we may not always act fully rationally, and/or on our own best interests.

In what follows, after having briefly dealt with the question of 'behavioral' methods or insights, we propose a taxonomy of five clusters of 'behavioral' health policies based on the extent to which, implicitly or explicitly, they seem to depart from the above basic view of 'conventional' economics. We will review the typical arguments that some health policies in fact depart very little from this basecamp framework, while other move furthest away. We then turn into the fundamental question of how effective is each of these clusters in changing health behavior, and review the available evidence for each of them.

3. Behavioral methods vs. insights: randomized controlled experiments and 'behavioral' policy.

The conceptual framework illustrated above allows dealing immediately with the first area of potential debate. There is the tendency to define a policy under the 'behavioral' umbrella merely because it entails the use of randomized controlled trials, or experiments in the lab or the field.

One who attended a recent debate promoted by DG SANCO at the European Commission for instance, could end up with the impression that the key feature of the various behavioral insights teams is that they pre-test possible policies interventions using controlled experiments involving a treatment and a control group (European Commission DG SANCO, 2013). Probably the most quoted report by the UK Behavioural Insights Team within the Cabinet Office illustrates the need to conduct 'randomized controlled trials' to develop public policy (Haynes et al., 2012).

As experimental researchers we warmly welcome the diffusion of experiments to support public decision-making. The use of controlled experiments comparing an intervention and a control group allows, in fact, to draw direct conclusions on whether a particular policy intervention is effective or not, whilst minimizing the potential confounders, and is thus arguably the only reliable way to be confident about causal inference.

On the other hand, however, we also see the point in the argument that the use of experiments has to do with the *methods* employed to gather evidence for policy purposes, not with the content and insights of such evidence. It is actually fair to notice that outside the context of policy decision-making the experimental method is far from being novel. It lies at the very core of the randomized controlled trials (RCTs) and of all modern evidence-based science, medicine, pharmacology, and psychology, and is certainly not a distinguishing feature of 'behavioral economics' only. Actually, the central idea about the experimental method is so old that one can trace it back as early in time as in some of the discussions contained within the Bible's Old Testament, such as: Daniel's test on the effect of nutrition on King Nebuchadnezzar's soldiers (Daniel, 1:1-16); or Gideon's test on the dew on the fleece of wool (Book of Judges, 6: 37-39).

The key point, however, is that we currently witness, probably for the first time ever, a diffuse and open-minded interest by policy-makers in rolling out randomized experiments to test policy interventions prior to their full-scale implementation (Ludwig, Kling, and Mullainathan, 2011).

A broad spectrum of different types of experiments spanning from the lab to the field can prove useful for policy purposes, including so-called 'artefactual', 'framed', and ‘natural’ field experiments, and ‘extra-lab’ experiments (Harrison and List, 2004; List, 2006; Charness, Gneezy, Kuhn, 2013). The choice of the specific best option can itself be informed by insights from the behavioral sciences, such as the preference for ‘natural’ field experiments (where subjects do not typically know that they are part of an experiment) to study behaviors that mostly occur unconsciously or automatically (List, 2011; Dolan and Galizzi, 2013a); or the strategy to link ‘lab’ and ‘field’ data to cross-validate responses (Galizzi, 2012).

The methodological, ethical, and practical aspects of conducting randomized controlled experiments in the health context can be challenging, and the resulting experiments can involve ‘behavioral’ methods, ‘behavioral’ insights, or both. Nevertheless, in our view, the mere fact that the use of experiments is spreading across health policy-makers is novel and important.

4. A taxonomy, and a review

A second area of potential debate is concerned with the nature, rather than the method, of the ‘behavioral’ health policies. Not only in popular press, there is often the presumption that very diverse policies such as comparison portals, financial incentives, and soda taxes are all directly inspired by insights from ‘behavioral’ economics. At a closer inspection, however, these policies depart to very different extent from the above ‘conventional’ economics paradigm.

We propose a taxonomy of five different clusters of health policy interventions: preferences-based policies; information-based policies; financial incentives; tax- and subsidy-based policies; and nudges. Before going into the details of each class of policies, we just draw an overall picture. Figure 4 graphically summarizes how the different clusters of policies relate to, or depart from, the ‘conventional’ economics model.

[Figure 1 in here]

In our framework, for instance, preference-based policies are directly related to the first ‘pillar’ of the ‘conventional’ economics model, and for this reason one can categorize them under the ‘conventional’ rather than ‘behavioral’ economics umbrella. Similarly, it is possible to closely associate a specific ‘pillar’ of conventional economics to each of the information-based policies (pillar 2), financial incentives (pillar 3), tax- and subsidy-based policies (pillar 4).

The design of both informational policies and financial incentives can, however, be directly inspired to genuine insights from ‘behavioral’ economics and behavioral science. In that case, these ‘behaviorally inspired’ information-based policies and financial incentives can appropriately be grouped under the ‘behavioral’ umbrella.

In our framework, policies based on ‘nudges’ substantially depart from ‘conventional’ economics, as they openly challenge its pillars 1-3, as we will discuss in section 4.5. Nudges can thus, appropriately, be viewed as a cluster of policies that are closely and comprehensively inspired by ‘behavioral’ research. In the next sub-sections, we review in greater detail both the rationale and the evidence beyond each element of the taxonomy.

4.1. Preference-based policies.

The first cluster of policies that go under the 'behavioral' umbrella are what we call '*preference-based*' policies. They are essentially based on the idea of providing people (and patients) broad sets and menus of choices from which they could pick their most favorite option. The broader these sets of choices are, the larger is the set of possible profiles of preferences that could be satisfied. In President Bush's words (on Medicare Plans B, see below): '*The more choices you have, the more likely it is you'll be able to find a program that suits your specific needs. In other words, one-fits-all is not a consumer-friendly program*' (White House, 2006).

In the health context the examples of this approach are numerous. In patients' choice this approach closely follows what Peter Ubel calls '*the patient empowerment revolution*' (Ubel, 2012). This is the idea that clinical recommendations cannot be simply dictated unilaterally by the doctor. Patients and doctors should instead work out together decisions taking into account patients' preferences for treatments and tests.

Similarly, in October 2013 the so-called '*Obamacare*' reform has launched the exchange portal https://www.healthcare.gov/ to help the 50 million US citizens without health insurance to compare, in a systematic way, the profiles of the healthcare insurances in 36 US states.

In the pharmaceutical sector, under Bush's administration the Medicare Part D website was launched in 2006 to help US seniors to choose among a wide variety of different drug plans provided by private healthcare companies. Similarly in several other industrialized country, more and more often policies prescribe the GPs and the pharmacists to actively present all the choices to the patient seeking for some prescriptions, or purchasing drugs, as for instance for the case of generics versus branded versions of the product.

Similar policies have been implemented, mainly in the US and in the UK, in the form of internet websites that rate hospitals and medical doctors, and allow patients to browse across different rankings (Lagu et al., 2010; Galizzi et al., 2012; Graves et al., 2012).

It is difficult to disagree with the view that more choices are good, especially when they allow overcoming the naturally predominant doctor-centered side of the decision-making, or when they also imply more competition on the supply side, as for the health insurance and pharmaceutical examples.

On the other hand, however, it is also easy to see the point in the argument that there is no genuine 'behavioral' insight in these policies. Rather than on 'behavioral' economics, this cluster of policies is, actually, soundly grounded on 'conventional' economics. What these policies seemingly assume is that people (and patients) have clear preferences over treatments, tests, health insurance schemes, pharmaceutical products, and that a broader set of choices will help them finding their most preferred option, something which is fully consistent with 'conventional' economics (pillar 1).

4.1.1. Do information-based policies work?

Whether really 'behavioral' or not, the fundamental question from a policy perspective, is: do information-based health policies work? Do policies expanding the sets of choices/actions lead to significant and sustained changes in health behavior? Here the simple answer is: '*we do not really know*'.

There are mainly two reasons why this is the case. The first reason has to do with the mixed evidence on the benefits and costs of having more options. The second reason is that it is methodologically difficult to draw a rigorous mapping between preferences and (health) behavior.

4.1.2. Are more options always good?

About the first reason, from a behavioral perspective, the potential benefit of broadening the choice set of options can be partly, or completely, offset by the paralyzing effect of having too many options among which to choose. In essence, making choices is effortful, tiring and can generate anxiety, and this is the reason why we often seek advices and suggestions; imitate what other do or just follow the crowd; stick to default options (Thaler and Sunstein, 2009; Salecl, 2010).

As the '*tyranny of choice*' literature shows, having more options often lead to worse, rather, than better, choices. For instance, consumers found more difficult to pick their favorite option (and then regretted it more often) when choosing from a set of 24 exotic fruits jams than from a subset of just 6 jams (Iyengar and Lepper, 2005). The reason is also that, with many more options, it is increasingly difficult to ascertain how the options differentiate from one another.

Making choices literally costs mental and physical fatigue. Subjects who had to go through a series of simple pairwise choices, felt so depleted that kept their hands in ice cold water for shorter time duration than subjects who simply had to contemplate the options without choosing (Vohs et al., 2008). In a corresponding example in the field, shoppers who spent longer time in a shopping mall gave up quicker to solve arithmetic puzzles (Vohs et al., 2008).

The 'tyranny of choice' is often so overwhelming that can leave us totally swamped, with the consequence of completely paralyzing decisions ('*paralysis by analysis*'). Compared to 'speed online daters' who only had a dozen of possible dates, online seekers had so many more potential daters' profiles that they just went on browsing and browsing, and, at the end, they typically went out dating *less* often than speed daters (in about 1% of the cases): *'when you have so many choices to choose from, you become absurdly picky and start striving for perfection'* (Hitsch, Hortacsu, Ariely, 2010).

In a more naturalistic (and relevant) environment, in some states senior US citizens often had to compare about 46 (and up to 225!) drug plans to choose their favorite option: no wonder why, less than a year after the launch, 73% of the American seniors found Medicare Part B Website '*too complicated*' to use (Thaler and Sunstein, 2008).

4.1.3. Preferences and behavior: an identification problem.

The second, methodologically more profound, reason is that, although it seems a very simple exercise to do, it is not easy to demonstrate a rigorous link between larger choice sets and better health behavior.

Empirically answering this question entails facing the 'curse' of the '*revealed preferences*' argument. In essence, it is in practice often impossible to empirically identify the effect of broader choice sets on individual behavior, simply because economists traditionally assume that behavior is just the manifestation of some underlying preferences.

Therefore, as in most cases we do not directly observe preferences and we only observe behavior, any type of behavior, even the most extravagant, can be easily justifiable in light of some latent, possibly 'exotic', preferences (Loewenstein, 2007).

In the health context, the 'curse' of the revealed preferences argument has originated some justifications of risky behaviors as the rational manifestation of some underlying preferences, as in the case of the various 'rational addiction' models (Becker and Murphy, 1988; Dockner and Feichtinger, 1993).

In several other occasions, the same issue has led eminent scholars to empirically use risky behaviors as direct and immediate manifestations of underlying preferences: thus, for instance, smokers and heavy drinkers are *ipso facto* identified with people who are more risk seeking and more present-biased in their risk and time preferences, respectively (Feinberg, 1977; Viscusi and Moore, 1989; Moore and Viscusi, 1990; Viscusi, 1990; Viscusi and Hersch, 2001; Hakes and Viscusi, 2007; Viscusi and Hakes, 2008).

From a behavioral perspective, though, those approaches are not fully convincing. Rather than directly measuring the actual subjects' preferences, the latter examples infer preferences from behavior, or 'super-impose' on observed health behavior the beliefs by the researcher about subjects' preferences.

There is something 'not behavioral' in this approach. One should, in fact, at the very least, attempt to measure the underlying preferences and attitudes. Only by directly comparing individual preferences and attitudes, on the one side, and health-related behavior, on the other, we may be in the position to draw inferences on whether the latter is indeed the genuine manifestation of the former, and to empirically test whether preferences and attitudes are significant predictor of actual behavior.

This calls for an effort to actually measure preferences and attitudes. Perhaps the three most salient preferences in the health context are preferences for health states, for risk, and for time (Gafni and Torrance, 1984; Redelmeier and Heller, 1993; Dolan et al., 1995, 1996, 1997; Cairns, 1992, 1994; Cairns and Van Der Pol, 1997; Van Der Pol and Cairns, 2001). As a case study, we briefly review the direct evidence on the links between health behavior and risk and time preferences.

The issue is particularly intricate as different approaches have been proposed by the behavioral literature to measure risk and time preferences. First, there is debate on whether risk and time preferences should be measured by attitudinal/survey questions or by experimental tests. Second, an issue concerns the use of either hypothetical scenarios, or real consequences for the individual responses in these experimental tests, something experimental economists call '*incentive-compatibility*' of tests. Third, a difference relates to the choice of the domain where to elicit risk and time preferences, i.e. either money or health, for instance. Finally, there is the question on whether the measures should be one-shot or repeated.

We refer to other works for excellent and more comprehensive reviews of the different approaches to measure risk and time preferences, and for critical discussions of their advantages and disadvantages especially in the health context (Frederick, Loewenstein and O'Donoughe, 2002; Bradford, 2010; Van Der Pol, 1996; Andersen, et al., 2012; Galizzi and Miraldo, 2012; Charness, Gneezy, and Imas, 2013).

To review the evidence, we take here a very specific perspective, the one of experimental economics. Experimental economists, in fact, have developed a set of strong arguments to support the need to measure risk and time preferences using incentive-compatible tests, that is, based on the idea of giving real-money financial consequences for responses (Cummings, Harrison, and Rutstrom, 1995; Harrison, Lau and Williams, 2002; Holt and Laury, 2002; Andersen et al., 2008). The typical arguments include the idea that subjects do not exert adequate attention and cognitive effort when choosing between options in hypothetical tests; that there is otherwise 'too much noise' and inconsistency in the choices; and that most situations involving trade-offs between risk and time in the real world have indeed real financial consequences, and thus is just appropriate to measure preferences under the same conditions.

In other words, if we really want to maximize the likelihood to effectively capture the underlying risk and time preferences, we should pay subjects real money based on their responses. This is arguably the most conservative perspective to document a statistically significant association between directly measured risk and time preferences and health behaviors, if such a link is really out there. Imagine, in fact, that we use a measure for preferences that is not incentive-compatible. Then if we do not observe any link between this measure and health behavior, we could always suspect that it is the experimental measure that is flawed, and is unable to capture the underlying preferences.

4.1.3.1. Stability of experimentally elicited risk and time preferences.

In behavioral science, measuring an attitude or a trait (such as risk or time preferences, for instance) is considered practically useful if it satisfies three 'validity' criteria, namely:

1) It remains reasonably constant across time within a particular individual (stability).
2) It predicts behaviors across a wide range of situations (external validity).
3) Different measures of the behavioral trait correlate highly with each other (internal/cross validity).

For instance, as Frederick, Loewenstein and O'Donoughe (2002) suggest, cognitive ability is a useful trait to measure, as it satisfies all these three criteria: at early stage it correlates well with cognitive skills at subsequent stages; it predicts important life outcomes such as income and criminal behavior; different measures of cognitive ability correlate strongly with each other. What about risk and time preferences? Are they also equally useful to measure, according to these three criteria?

On stability, first. There are very few 'longitudinal studies' that have been properly conducted in order to test the temporal 'stability' of risk and time preferences. Experimental tests have been typically conducted at one point in time, and the very few studies that have repeated observations, often use different measures of the traits over time (Mischel, Schoda, and Peake, 1988); short time horizons (Kirby, 2009); relatively small numbers of repeated observations (Andersen et al., 2010; Zeisberger et al., 2012); and/or non representative pools of specific subjects (Meier and Sprenger, 2010).

4.1.3.2. Internal (cross) validity of experimentally elicited risk and time preferences.

Moving to the question of internal/cross validity, there is surprisingly weak correlation between various measures of risk/time preferences. For instance, we essentially do not know to what extent different incentive-compatible tests such as the Holt and Laury (2002), the Eckel and Grossman (2006), or the Gneezy and Potters (1996) test, to name just a few, correlate each other.

Moreover, very little is known on whether, and to what extent, survey attitudinal measures really associate with experimentally measured risk and time preferences. Dohmen et al., (2009) argue that survey measures relate to a good extent with Holt and Laury (2002) tests. Szrek et al., (2012), however, found that the Holt and Laury (2002) tests are not significantly correlated with the Dohmen et al., (2009) survey measure, nor with other common risk-taking propensity measures (e.g. BART, DOSPERT).

Furthermore, and even more substantially, evidence exists that both risk and time preferences substantially differ across different domains, such as health and finance, for instance. For evident ethical and practical reasons is often difficult to ensure that risk and time preferences are elicited through incentive-compatible methods over health outcomes. Most studies, thus, resort to comparing hypothetical scenarios in monetary and health contexts.

As for time preferences, Chapman and Elstein (1995) and Chapman, Nelson, and Hier (1999) found only weak correlations between discounting rates for health and for money.

Similar intra-individual inconsistencies across life domains have been documented for risk preferences too (Hanoch, Johnson, and Wilke, 2006; Barseghyan and Prince, 2011; Einav et al., 2012). Risk attitudes are indeed so domain-specific that several domain-specific tests have been proposed to effectively differentiate between risk attitudes in different domains (e.g. DOSPERT, Weber, Blais, and Betz, 2002; Blais and Weber, 2006). Even within the same health domain, risk preferences can actually differ across different context (Van Der Pol and Ruggeri, 2008; Butler et al., 2012). Moreover, significant intra-individual differences in preferences emerge across monetary and health domains even when preferences are measured using a multiple price list (MPL) test with essentially the same structure across the two domains (Galizzi, Miraldo, and Stavroupolou, 2013).

The finding that intra-individual preferences can differ across different domains is generally consistent with the idea that both risk and time preferences involve not just merely high-level cognitive constructs but also emotional factors (Loewenstein et al., 2000; Frederick, Loewenstein and O'Donoughe, 2002). A growing number of studies, in fact, have demonstrated that the measurement of risk and time preferences can be significantly affected by manipulating the underlying emotions and moods of respondents (Fehr-Duda et al., 2011).

More generally, rather than monolithic traits, risk and time preferences can be seen as the complex amalgam of very different fundamental psychological motives, involving both emotional and cognitive factors such as: '*fear*' and '*anxiety*' (Finucane et al., 2000; Loewenstein et al., 2000; Slovic, et al. 2004), or '*sub-proportionality*' of weighting probabilities (Epper, Fehr-Duda, and Bruhin, 2011) for risk preferences; or '*impulsivity*' (Ainsle, 1975), '*visceral factors*' (Loewenstein, 1997), '*sub-additivitity*' of time horizons (Read, 2002; Read and Scholter, 2006), '*non-linear subjective time perception*' (Takahashi, Oono and Redford, 2008; Zauberman et al., 2009; Bradford, Dolan, Galizzi, 2013) for time preferences.

Therefore, even if we manage to accurately measure risk and time preferences with incentive-compatible tests - and this is most likely to be the case in the monetary domain - we cannot be sure whether the same attitude would apply for health-related decisions.

4.1.3.3. External validity of experimentally elicited risk and time preferences.

Thirdly, on the external (ecological) validity, the evidence on the association between risky health behaviors and patterns of risk and time preferences is modest at the least.

For what concerns smoking, for instance, Dohmen et al., (2009) found correlation of smoking status with the survey measure for risk attitude in health, but not in finance (the correlation with incentive-compatible test is not reported). Similarly, Barsky et al., (1997) find only weak correlation between survey measures for risk preferences and smoking. Although Anderson and Mellor (2008) found some correlation between experimental proxies for risk aversion and smoking habits, the statistical effect is marginally significant and not robust to slight changes in the thresholds used to define a 'smoker'. Both Harrison et al., (2010) and Galizzi and Miraldo (2012), in fact, failed to find significant association between the directly estimated degrees of risk aversion and the individual smoking status. Similarly, Szrek et al., (2012) found no significant association between the Holt and Laury (2002) test for risk aversion and smoking behavior. As for the link between smoking and time preferences, Chabris et al., (2008) found only weak correlation between survey measures and smoking, while Harrison et al., (2010) found no statistically significant patterns of experimentally measured time preferences between smokers and non-smokers.

Concerning unhealthy and excess eating, Borghans and Golsteyn (2006) found very low correlations between experimentally measured time preferences and BMI. Similarly for risk preferences, Anderson and Mellor (2008) found some correlation between experimental proxies for risk aversion and the BMI, but the effect is, again, only marginally significant and is not robust to slight changes in the BMI-based ‘thresholds’ to define ‘obese’ or ‘overweight’ subjects. Also Galizzi and Miraldo (2012) found that the statistical significance of the association between risk attitudes and BMI is not robust and completely disappears when broader and more comprehensive indexes for the overall nutritional balance, such as the healthy eating index (HEI), are employed.

Similarly weak correlations of risk and time preferences measures have been found with alcohol consumption (Barsky et al., 1997; Anderson and Mellor, 2008; Galizzi and Miraldo, 2012; Szrek et al., 2012); exercising (Borghans and Golsteyn, 2006); and other risky health behaviors (Szrek et al., 2012).

So, all in all, little and mixed evidence exists on whether experimentally elicited measures for risk and time preferences predict risky health behaviors, and so, ultimately, on the external validity of such ‘behavioral measures’. We need more direct evidence on the three questions of the stability, internal validity, and external validity of experimental measures for risk and time preferences, especially for representative samples of the population (Galizzi, 2012).

As the current evidence stands, it seems quite a leap of faith to conclude that ‘behavioral’ policies providing more options, with the vision of better matching the underlying individual preferences, would automatically lead to significant and sustained changes in health behaviors.

4.2. Information-based policies.

Proceeding down the list, the next cluster of ‘behavioral health policies’ is centered on the idea of providing information to patients and consumers, to enable them to formulate better decisions. There are numerous examples of this type of health policies in OECD countries: from the ‘*Smoking kills*’ messages on packets of cigarettes, to the ‘*5 a day*’ labels on fruit and vegetables, from the ‘*3 alcohol units a day*’ messages, to food nutritional labeling.

It is not difficult to argue that, rather than on ‘behavioral’ insights, information-based policies sound quite firmly grounded on ‘conventional’ economics: accessing more, or better, information enables us to make better decisions and plans (pillar 2). The key question, however, is again: do information-based policies work? Here the short answer is: ‘*yes and no, but mainly no*’.

Three considerations are in order. First, merely providing more information is generally effective in raising awareness, but does not necessarily *per se* lead to significant and sustained change in behavior. Second, mere information release can actually trigger unintended consequence and even lead to ‘perverse’ effects. Third, information release can work only when its design is inspired to, and ‘supercharged’ by, genuine behavioral insights. Below we will bring evidence on these three aspects in greater detail.

4.2.1. 'Pure' information-based policies.

Do mere information-release health policies work? Concerning, more specifically, information on healthy eating, the existing evidence is mixed at the best. As two specific case studies, we briefly consider the evidence on i) informational campaigns; and ii) food labelling.

Informational campaigns seem to raise the level of awareness, but are not, per se, able to trigger significant behavioural changes. This, for instance, is likely the case of the *5-a-day* campaign, an informational campaign run in the UK between 2002 and 2004 to educate British people to eat at least 5 portions of fruits/vegetables a day. Its effects have been confined to a raise in awareness: although a modest change in behaviour (correcting for changes in prices) have been found, the lower income families reacted much less to the campaign, and still consume half the fruit and vegetable portions than the richer ones (Mazzocchi, Trail, and Shogren, 2009).

Another example of mere information release refers to the case of nutritional labels. It is well known that there are essentially two 'archetypical' models of nutritional labels: a) the so-called Guidelines for Daily Amounts (GDA) system, with full numerical nutritional information side by side with daily recommendations; and b) the visual 'signpost' or 'traffic light' labels, with simplified green, amber, and red lights.

In principle one can argue that the GDA scheme should be preferable as it provides consumer full nutritional information. Compared to this, however, the alternative 'traffic lights' system has the main advantage of being closer to the 'behavioral' insights that visual cues may be much more salient and powerful than plain information disclosure. Surprisingly, however, the direct evidence on the relative effectiveness of the two systems is relatively scarce.

Concerning the effect of pure calories and nutritional information in general, the available evidence suggests a minimal or modest impact on food purchase and behavioural change (Downs et al., 2009; Dumanowsky et al. 2011; Harnack et al., 2008; Schwartz et al., 2012).

Concerning the effect of signpost, in particular, there is some evidence of 'local substitution effects': consumers tend to avoid really 'bad' foods, switching from 'red' to 'amber' lights, rather than choosing genuinely healthy foods ('green' light) (Fox et al., 2002). This is consistent with the main idea what 'bad' and negative messages are generally more salient and easier to retain than 'good', positive messages (Baumeister et al., 2001; Dolan, Galizzi, and Navarro-Martinez, 2013). The evidence on local substitutions effects' is also consistent with the 'macro' observation that consumers tend to switch to healthier options within the same categories, but they rarely radically alter the overall structure of their diet (Kessler, 2009).

4.2.2. 'Perverse' effects of information policies.

Moreover, not only simple nutritional or calories labelling are unlikely to have beneficial effects, but they may even have unintended 'perverse' effects that can completely offset the possible beneficial effects.

Jue et al., (2012) studied interventions aiming to shift consumption toward zero calories beverages in three sites in Philadelphia. The study implemented five different interventions, involving: 10% price discount of zero calories drinks, messaging on calories information; messages on exercise equivalent information (minutes on the treadmill to burn the calories); or combinations of these interventions. The study essentially fails to find consistent and significant effects across the interventions with only two exceptions: consumption of zero calories drinks increased under the 10% discount, and the consumption of sugar-sweetened drinks increased (rather than decreased) in the calorie messaging intervention.

Wansink and Chandon (2006) found similarly 'perverse' results associated with '*low fat*' labels: subjects who were given snacks with '*low fat*' labels consume 50% food (and 84 calories) more than subjects without the '*low fat*' label. One of the reasons was that subjects underestimated the calorie content of the snacks by 48-50% (about 260 calories) and felt 'less guilty' to consume it more.

Other perverse results have found to be triggered by labels for the portions' size. For instance, consumers who were given identically large portions of spaghetti, ate significantly more (and left 10 times less food in their plates) when it was labeled '*Regular*' than when it was labeled '*Double-size*' (Just and Wansink, 2013).

Furthermore, there is some evidence on potentially 'perverse' interaction between calories and nutritional information, and other types of health claims, such as '*high in omega 3/gluten free/fair trade/zero emission*' and similar. For instance, there is evidence of *'health halo effects'* that makes the information contained in nutritional labels overridden by other types of, unrelated, information: when asked to rate the taste and caloric content of yogurts and crisps, subjects estimated that the food labelled as '*organic*' had significantly lower calories than identical food labelled 'regular' (Wan-Chen et al., 2013). The extra 'health claims' can also, in principle, serve as a '*licensing*' motive to induce to eat even larger portions/quantities of that food item (see below for a discussion on this).

4.2.3. 'Behaviorally' inspired information policies.

This preliminary evidence suggests that 'pure' calories and nutritional information release is unlikely to change behaviour, and can even have adverse effects. More effective results are generally reported for public interventions that design and 'super-charge' information release based on insights genuinely inspired to behavioural science. This is, for instance, the case for presenting the same information together with some visual cues that make it more salient.

Some evidence on this direction comes from the study by Wisdom, Downs, and Loewenstein (2009). The experiment was run with about 1,200 subjects recruited for survey study, in exchange for free snacks. Subjects were randomly assigned to a control group (no information at all) or to one of 9 labelling conditions, varying from calories information only, to daily intakes references, from information about the minutes to spend on a treadmill to burn the calories, to a 'traffic lights' rating, to some heuristic cues such as the expected body size associated with the food. The dependent variable was the observed number of calories in the snacks chosen by the subjects.

The caloric intakes were significantly lower than in the control group only when the 'pure' nutritional information was accompanied by information on the number of minutes on the treadmill (about -10%); by visual cues like the 'traffic lights' (about -20%); or even better by the expected body size (about -25%).

4.2.4. Nutritional information on meals out?

There is another reason why nutritional labels on food items are unlikely to have major effects on changing healthy eating behaviour. The reason is related to the fact that, in OECD countries, eating habits are changing over time. Despite the increase in work productivity allowed by modern technologies, we do work more and more hours a day (Lawdawalla and Philipson, 2002), engage longer time in mixed social/work activities, and as a result we have compressed the time we spend at home, including the one dedicated to cooking (Cutler, Glaeser, and Shapiro, 2003). As a result, more and more meals are ready prepared or consumed out, generating restaurants' sales in excess of $300bn a year in the US only (Kessler, 2009; The Economist, 2012). This hampers the impact of nutritional information on food items, and shifts the attention to meals out.

No country has yet implemented a comprehensive policy of imposing calories labelling on all meals out. In the US, however, in New York City, the Department of Health passed a legislation mandating that from 1st July 2007 all food establishments with standardised portions (basically, all major chains of coffee shops and restaurants) have to post calorie information on their menu boards besides the prices. While similar practices have been voluntarily extended worldwide by some companies involved in NYC (*McDonald's, KFC, Pizza Hut, Pret a Manger*), the Obama Administration currently intends to extend the NYC experience to all the US. Which lesson can we learn: do calorie labelling policies work on meals out?

A study by Downs et al. (2013) tested whether this information affected food choices by collecting data at three locations (a coffee shop in Manhattan, and two hamburger restaurants of the same chain: one in Manahattan, the other in Brooklyn). Researchers standing outside the restaurants randomly assigned customers to two treatments: in one treatment, they received information about suggested calorie intake per day, in the other calorie intake per meal. They found no impact of the legislation and of either calories recommendation at the coffee shop; no impact of the legislation in the restaurant in Manhattan, while fewer calories were consumed after the legislation in the restaurant in Brooklyn, especially by people that were already on diet.

The same message is reinforced by other analyses, most of which do not find any reduction in calories after posting calories labels. Dumanowsky et al., (2011), for instance, compared calorie information when it was mandatory and when it was not, and found that only 15% of the consumers actually used the calories information, and that its use had little impact on calories bought in general, and no impact on the amounts of total fat, saturated fat and cholesterol in foods.

These results provide evidence that labelling policies on meals out tend to have a modest impact, especially on specific groups of the population. Other evidence, however, suggests that calories information on meals out may even have unintended ‘perverse’ effects.

Downs et al., (2013), for instance, found that calories-per-meal recommendation significantly increased the caloric intake of people on diet relative to non-dieters. In another field experiment, Wisdom, Downs and Loewenstein (2010) approached customers entering a fast-food sandwich restaurant and offered them a free meal in exchange for participating into a survey. Customers who agreed to participate were asked to pick a sandwich, and then a side dish and a drink, from a provided menu; they next completed the survey; and were finally handed a coupon with their order to be given to the restaurant. The different treatments interacted the presence of daily calorie recommendation, of calorie information for menu items, and of different convenience/saliency of the healthy options: in one treatment healthy options were the default choices in the first page of the menu, in another there was an immediate extra effort required to order a less healthy option (opening a sealed packet).

Wisdom, Downs and Loewenstein (2010) found that both calorie information and calorie recommendation decreased calories in ordered foods. Both convenience/saliency interventions increased the likelihood to choose sandwich options with lower calories. The default option, however, appeared to also induce a ‘compensatory effect’ on non-sandwich calories: subjects in that treatment also consumed side dishes and drinks with higher calories, and that completely offset the beneficial impact of calorie information.

Wisdom, Downs and Loewenstein (2010) suggest a possible interpretation of such unintended effects in terms of ‘*licensing*’: all subjects in the default treatment were likely to have turned the menu page and read the additional, less healthy, options in there, before choosing their side dish and drink. Thus ‘*choosing from the healthy menu may have led to a sense of deservingness upon seeing the unhealthy sandwiches that were passed up, leading people to reward themselves with higher-calorie side dishes and drinks*’ (p. 171).

Chandon and Wansink (2007) found similar results with the ‘*healthy*’ message: consumers in a fast food perceived as ‘healthy’ (*Subway*) were more likely to underestimate their intakes by an average 150 calories than if eating in a fast food perceived as ‘unhealthy’ (*McDonald’s*). Moreover if their main course was a ‘healthy’ option, they were more likely to purchase a side dish, drink, or dessert than if they had an ‘unhealthy’ main course, and the side dish/drink/dessert they chose contained 131% more calories.

This evidence on labelling on meals out further reinstates the point that information on its own is unlikely to lead to significant and sustained changes in health behaviour. It can work when its design is inspired to genuine behavioral insights, whereas ill-informed designs can even lead to adverse consequences.

4.3. Financial incentives.

Next in the list are the 'behavioral' health policies based on financial incentives. A premise is in order here. We consider in such a cluster only the policies based on the idea of providing monetary incentives conditional to a specific change in behavior: for instance, paying £100 smokers when they quit smoking; giving obese patients lottery vouchers when they lose weight.

This definition is important to distinguish these policies from other related policy interventions that are often pooled together. For instance, the fact to provide monetary incentives based on a predefined action or change in behavior makes the financial incentives inherently different from subsidies or taxes.

What taxes and subsidies do, in fact, is that they directly interfere with market prices. Taxes and subsidies act as hedges between the producers and the consumers, and market prices are increased or decreased by their introduction for all consumers, independently from the course of actions they undertake. Taxes and subsidies, of course, aim to (and are often able to) cause changes in behavior. As a result of their introduction, consumers often change their plan of actions, and can for instance incur in 'deadweight losses' as illustrated by the textbook examples in 'conventional' public economics. The main point, however, is that subsidies and taxes change behavior only as long as they directly interfere with market prices. Financial incentives, on the contrary, do not *per se* alter the market prices.

One can argue that, according to the above conceptual framework, financial incentives rely on limited 'behavioral' insight, and are not a distinguishing feature of 'behavioral' economics. Incentives are actually one of the main hallmarks of 'conventional' economics, being directly related to 'pillar' 3 of the above framework. Economics as a social science can actually be defined largely as the study of incentives and their impact on changing behavior: by the '*basic law of behavior*' (Gneezy, Meier, Rey-Biel, 2011) after a well-designed incentive is introduced, behavior should change in the envisaged direction.

Two questions are of practical interest from the 'behavioral' perspective. First of all, which types of financial incentives have proved to really work, in the sense to sustain significant behavioral change in the long run? Second, provided that those incentives lead to the envisaged change in the targeted behavior, at least in the short run, do they also have unintended 'perverse' consequences?

As for the question of which financial incentives really work in health behaviors, the short answer is that the only compelling evidence refers to financial incentives schemes that have been designed as based on 'behavioral' insights. At the contrary, 'pure' conditional monetary amounts, tend to work in the short run as expected, but are generally not sufficient to lead to sustainable changes in health behavior, especially when incentives are removed.

4.3.1. 'Pure' monetary incentives.

'Pure' monetary incentives tend to be effective in the short run, of few weeks or months, but can hardly be sustained over time. The direct evidence on periods of several months or more is generally that there is no statistically significant difference across incentivized and non-incentivized arms of the trial.

Examples of such evidence refer, for instance, to financial incentives for smoking cessation. An early randomised controlled trial by Higgins at al., (2004), for instance, paid pregnant women vouchers that were contingent or not to quitting smoking, and observed subjects during pregnancy and 12 weeks after vouchers were removed. As expected, contingent vouchers were more effective in inducing smoking cessation and effects were sustained up to 12 weeks after the end of the vouchers.

A similar study by Volpp et al., (2006) considered 179 smokers who were participating to a five sessions nicotine patches program during 8 weeks and randomly gave some subjects $20 for each session they were participating, plus $100 if they actually quitted smoking at the end of the program. In the short-run, 75 days after the end of the program, quitting rates were significantly higher in the incentive group. Six months after the end of the program, however, quitting rates were not significantly different across the treatment and the control groups.

More sustained results for smoking cessation are documented when ‘pure’ monetary incentives are repeatedly paid out at regular time intervals even after the end of the program. Volpp et al., (2009), for instance, randomly assigned 878 employees of a US company to receive either information about smoking cessation programs, or information plus monetary incentives: $100 for completion of a smoking-cessation program, $250 for cessation of smoking within 6 months after study enrollment (as confirmed by a biochemical test), and $400 for abstinence for an additional 6 months after the initial cessation. Subjects in the incentive group had significantly higher rates of smoking cessation up to 18 months after enrolment.

Evidence is less encouraging for ‘pure’ monetary incentives for weight loss. Early randomised control trials typically found that, although incentivized groups had quicker and significantly larger weight losses than in the control group, they regained substantial weight three months after the end of the incentive, suggesting that maintaining weight loss is the key problem (Jeffery et al., 1978; 1984).

Coherently with the idea that incentives usually work for tasks that are sufficiently simple and under our full control (Camerer and Hogarth, 1999), purely monetary financial incentives have been proved to work well for the case of physical exercise too. Charness and Gneezy (2009), for instance, randomly assigned university students to three groups: either a control group where they were given hand-outs explaining the health benefits of regular physical exercise; or a low incentive group, where they received $25 if they attended the gym at least once a week; or finally a high incentive group, where they received $100 if they attended the gym at least 8 times a month. Subjects were observed up to seven weeks after the incentives were removed. Post-intervention attendance of gym was significantly higher the high incentive group than in the other two arms.

4.3.2. Unintended ‘spillover’ effects of financial incentives.

An aspect of financial incentives for health behavior that is of key interest from the ‘behavioral’ perspective is whether financial incentives may also have unintended ‘perverse’ consequences. In particular, it is conceptually possible that even financial incentives that are indeed successful in triggering changes in behavior in the envisaged direction (e.g. quitting smoking, losing weight) may have spillovers on behaviors other than the ones directly targeted.

For instance, incentives seem to work well to induce more physical exercise. But, do subjects who are paid to exercise more also eat more calories afterwards? Do subjects who quit smoking, also indulge more in other unhealthy activities, such as eating more snacks or unhealthy foods?

A complete answer to this question would require access to a comprehensive database encompassing all health-related behaviors for pools of subjects exposed to incentives, and compared them over time with a sample of subjects behaving in absence of incentives. Tentative evidence on the possible 'spillover' effects of financial incentives in health thus comes from tailored lab-based experiments looking at specific spillovers occurring in the short run.

Dolan and Galizzi (2013b), for instance, refer to the case of physical exercise. Subjects were asked to step as many times as they could for two minutes. Subjects were randomly assigned either to a control group, with no financial incentives; or to a high-incentive group, where they earned 10p for each step; or a low-incentive group paid 2p per step. After the experimental stepping task, all subjects were offered a buffet lunch in another room next to the lab. Unbeknownst to subjects, all food items, snacks, and drinks consumed were recorded. Compared to the control group, low incentives increase effort and have little effect on eating behavior. High incentives also induced more effort but led to significantly more excess calories consumed: subjects in the high incentive group burned about 17 calories, compared to 11 in the control, but ended up consuming 200 calories more than in the control arm. The key behavioral driver for this effect appeared to be the level of satisfaction associated with the physical activity task, which 'licensed' highly paid subjects to indulge in more energy-dense food.

These findings are coherent with the mounting evidence documenting 'licensing' effects in a variety of health contexts, starting from the ones above from nutritional information (Wisdom et al., 2010; Chandon and Wansink, 2007). For instance, in Werle, Wansink, and Payne (2010) subjects who were asked to read a scenario where they were walking 30 minutes while listening music at their MP3, then served themselves 51.8-59.8% more snacks than subjects in a control group who read a neutral scenario. Similarly, subjects who were exposed to eight exercise commercials ate more calories for lunch than subjects exposed to neutral commercials (Van Kleef et al., 2011). Analogously, in Chiou, Yang, and Wan (2011) subjects were given placebo pills and said that were either multivitamins supplements or placebo: subjects told that they were multivitamins then expressed higher preferences for risky unhealthy activities, and walked less to return a pedometer than subjects told the pills were a placebo.

Although more evidence is needed on this point, the preliminary insights are that financial incentives can have 'compensatory' spillover effects on other dimensions of health behaviors, which can potentially dampen or limit the overall health benefits of incentive-based interventions. This is coherent with the evidence reviewed by Dolan and Galizzi (2013a) that 'behavioral spillovers' ('*promoting*', '*permitting*', or '*purging*' in their taxonomy) are pervasive as broadly documented by the literature in behavioral sciences.

4.3.3. 'Behaviorally' inspired incentives.

The second key aspect that is of key 'behavioral' interest, relates to which kind of financial incentives can lead to sustained behavioral change. In a nutshell, financial incentives have proved to work particularly well when they are designed based on direct insights from behavioral economics. In particular, incentives work when, in coherence with the '*asymmetric paternalism*' approach by Camerer et al., (2003) and the '*libertarian paternalism*' approach by Thaler and Sunstein (2003; 2008), they are designed around our biases, in the attempt to help us to change behavior. From this perspective, 'behaviorally' supercharged financial incentives can be seen as an application of the 'nudging' policy approach, which is directly inspired to behavioral economics (see section 4.5).

Here we review some key cases where empirical evidence has been gathered on the successful impact of such behaviorally 'super-charged' incentives. The evidence is mostly due to the work of David Asch, George Loewenstein, Kevin Volpp, and colleagues at the Centre for the Health Incentives and Behavioral Economics at (CHIBE) at University of Pennsylvania.

In their set of experiments on weight loss, for instance, incentives have proved to work when they are designed to account for, and lever on, our biases, such as the tendencies to: over-evaluate small probabilities (e.g. by paying $100 with 10% probability, instead of paying $10 for sure); attach a greater value to losses than gains of the same amount (e.g. by asking subjects to put their own money down in deposits that are then matched by the program 1:1, and then deducting money from these deposits any time subjects fail to change behavior, playing on subjects' aversion to lose their deposit); be over-optimist about personal achievements (e.g. so that when asked to put money down as deposit, most people believe they will succeed in losing weight and do put down the money); appreciate immediate feedback on our actions (e.g. by providing immediate, personalized, and punctual feedback using text messages in forms of small rewards and punishments); regret the actions we did not take in the past (e.g. by informing subjects about the money they could have earned if they had indeed changed behavior whenever any time they did not).

Volpp et al., (2008), for instance, randomly assigned 57 obese men to three groups and followed them during 16 weeks of intervention, plus a six-months follow-up period. The control group was a weight-monitoring program: subjects had to weigh every morning before breakfast and call a number to report their weight. Also, every end of the month, all subjects had to weigh on a clinical scale to see if they were below their weight target.

In the deposit group, subjects could contribute between $0.01-3.00 each day of month. Their amount was matched 1:1 by the experimenters, who also added $3 per day, so that subjects in the group could gain up to $252 a month. The deposit, however, was only refundable if, at the end of the month, they met (or were below) the assigned target for the weight loss.

Finally, subjects in the lottery treatment were eligible for a daily lottery only if they reported a weight at (or below) their goal: the lottery paid frequently small payoffs ($10) and infrequently large payoffs ($100).

Moreover, every day, right after their reports, subjects received text messages on their mobile phones that informed them about how much money they have earned that day in case they have achieved the target, and, if unsuccessful, about how much they would have earned if they had reached target.

Subjects in deposit and lottery treatments lost significantly more weight after 16 weeks than in the control group. The less encouraging finding concerned longer term effects: 7 months after the end of the incentives, subjects in treatment groups still weighted significantly less than at the beginning of the program, but there were no significant differences in weight loss compared to the control group.

The CHIBE team has then extended the application of these ‘behaviorally’ inspired financial incentives for weight loss. One direction is to consider longer periods of time over which the weight loss can be sustained. This was done by John et al., (2011) who implemented two incentives in form of deposit contracts with elderly obese subjects: participants put their money with 1:1 match by the program and could lose their money if they failed to lose weight after 32 weeks. They found that participants in the incentive arms lost more weight than in the control group. The same findings were confirmed by a further analysis by John et al. (2012).

The second direction is to compare the effects of group versus individualized incentives. Group incentives, in fact, add to the behaviorally inspired ingredients of incentives also the pressure by social norms and peer monitoring. Kullgren et al., (2013) find, for instance, that group-incentivized obese adults lost more weight than individually incentivized subjects during the 24 weeks of the incentives program.

The evidence gathered by the CHIBE team suggests that incentives directly inspired to behavioral economics principles can in fact lead to significant change in dieting and healthy eating behavior to periods of up to 8 months. The main open question is that in a follow-up 36 weeks after the end of the incentivized intervention, there was weight regain in the incentivized subjects: the difference in weight loss between the incentive and the control group was no longer significant (John et al., 2011, 2012). Although the long-term maintenance is a challenge for weight loss programs in general, this casts some doubts about the long-term effects of financial incentives for weight loss, as well as for quitting smoking. Moreover, it represents a serious practical constraint for the public budget to roll out any large-scale replication. Given the association to potential chronic health conditions (obesity, CVDs, diabetes), in order to be sustainably effective, incentives likely need to be paid out over periods of years or decades.

A possible way out of this challenge revolves around the possibility to further boost financial incentives using again insights from behavioral economics, as discussed by John et al., (2012). A possibility, for instance, is to boost deposit rates over time, for instance by increasing the matching rates of the deposit; or to taper incentives off gradually over time instead of suddenly remove them at the end of the program.

4.4. 'Fat' taxes and 'thin' subsidies

Next down the list are types of 'behavioral' policy interventions based on taxes and subsidies: typical examples are taxes on cigarettes and spirits as well as the periodical discussions on introducing taxes on fizzy drinks or sweets, as recently debated in US, Mexico, UK, France, Italy, for instance.

It is easy to argue that also these 'behavioral' policies are in fact firmly grounded on 'conventional' economics, in particular on its 'pillar' 4. They are essentially interventions related, or directly inspired, to the long history of market regulation in public economics: in the attempt to overcome market failures, the public decision-maker directly intervenes in markets, realigning market forces and prices.

The most typical examples of market failures in practice are 'externalities': the markets fail to take into account the overall social costs and benefits of the goods/services, which are not adequately reflected in prices. The classic public instruments to correct such externalities are taxes and subsidies: for instance the carbon taxes levied on carbon- and oil-based energy resources.

There is, in fact, an increasing consensus that many of the problems associated to risky unhealthy behaviors are due to externalities in the health-related markets. For instance, it has been advocated that, in many countries, the price of cigarettes is too low: not only it induces an excessively high demand for cigarettes especially among youngsters, but it also fails to reflect the huge societal costs for treating smoking-related diseases such as lung cancers, respiratory diseases, strokes and other cardio-vascular diseases (Gallus et al., 2013). This, in turn, justifies the introduction of taxes on cigarettes, which, together with other regulatory interventions, like banning smoking in public places, can at least curb smoking habits.

Similarly, the influential Sheffield Alcohol Policy Report has repeatedly argue that, at least in the UK, the price of alcohol is too low compared to the overall societal cost of alcohol abuse (including the indirect costs in terms of antisocial behavior and crime that are directly imputable to alcohol abuse: Meng et al., 2013). The introduction of a tax in the form of a minimum price per ABV unit has thus been proposed to increase the excessively low price of alcoholic drinks, in a ways similar to what implemented in other Northern European countries.

4.4.1. 'The price is wrong'.

More recently, an analogous line of arguments has been brought forward by leading scholars, pointing to food prices as drivers of the ongoing obesity epidemics. Loewenstein (2009), for instance, argues that '*the price is wrong*': the price of foods is kept by the food industry at an artificially low level which does not reflect the 'true' high external societal costs related to unhealthy and excessive food consumption. With such excessively low prices, the food industry does not directly bear the higher 'external' costs to society of health consequences of overeating unhealthy foods.

Similar responsibilities by the food industry have also been brought forward in light of the fact that the vast majority of the billions of dollars spent every year in the US to advertise foods and drinks are spent in the 5 least healthy and most energy-dense food categories: namely, fast food; sweetened soft drinks; confectionery and candies; savory snacks; and sugared cereals (Mazzocchi, Trail, and Shogren, 2009; Kessler, 2009).

Many factors, in fact, can explain the relatively low prices of food in OECD countries. For instance, although prices of foods have decreased in real terms in 1975-2005 (Mazzocchi, Trail, and Shogren, 2009), in the same period, the prices of carbonated drinks, sugars and fats have decreased by a larger extent than prices of other foods, such as vegetables: for instance, while the real price of fruits and vegetables rose by 17% in 1997-2003, the real price of 2-liter bottle of Coke fell by 35% in 1990-2007 in the US (Mazzocchi, Trail, and Shogren, 2009).

The above trends have made high-calories-for-nutrient foods cheaper and cheaper than low-calories-for-nutrient foods: in the US, carrots cost more than 5 times than chips, orange juice cost more than 5 times per than Coke, and price per calorie of vegetable/fruit has increased over time much more (+40%) than snacks and other energy dense foods (-23%) (Drenowswki, 2003, 2004). Also in Israel vegetables were found to cost more than 3 times than candies in supermarkets (Gandal and Shabelansky, 2009).

The introduction of taxes has thus been advocated to realign the food prices to the societal costs of over-eating. The correction of an externality is in fact the main economic argument beyond the discussion of introducing taxes on foods containing high amounts of (saturated) fats ('fat tax'), or of sugars (e.g. 'soda tax' on sweet drinks), and related subsidies on fruits and vegetables ('thin subsidies'), all of which are essentially 'conventional' economic tools.

The key question, here, is whether 'fat taxes' and 'thin subsidies' indeed work in practice. The short answer to this question is that we do not really know, simply because, at date, no single country has yet implemented a comprehensive policy based on 'fat taxes' and 'thin subsidies'. Most evidence, thus, comes from exploratory simulations and experimental tests.

4.4.2. 'Fat' taxes.

Economic simulations, for instance, suggest that 'soda' or 'sweets' taxes can generate major tax revenues, up to $40mn a year in Arkansas only, and about $1bn in the US (Mazzocchi, Trail, and Shogren, 2009). This is not too surprising if it is taken into consideration that in the US soft drink sales reached a total of more than $90bn in 2011 (The Economist, 2012). Other recent studies have found that a 10% increase in the prices of soda drinks would lead to 8-10% decrease in their consumption (Andreyeva et al., 2010; Block et al., 2010).

The health benefits can be equally remarkable. For instance, it has been calculated that, in the US, an increase in VAT up to 17.5% on fat foods can reduce ischemic risks of 1.8-2.6% with more a 1,000 lives saved a year (Marshall, 2000).

The introduction of fat or soda taxes, however, is not without problems. In particular, a number of simulations and preliminary studies have documented that, while soda/fat taxes seem to be effective in reducing consumption and detrimental health effects, they also tend to act asymmetrically on the different segments of the population.

For instance, a simulation of the introduction of fat tax in the UK based on actual calories consumption, found that 2% of lowest-income consumers would pay 7 times as much the proportion of their income as the 2% highest-income consumers (Leicester and Windmejier, 2004). Similarly, it has been calculated that, although a tax proportional to fat content can reduce fat intake of 1%, its burden would be 10 times higher among low than high income consumers (Chouinard et al., 2007).

In particular, they are typically regressive in that they cause a higher reduction in consumption in the lower-income households. And this is essentially for three reasons: poorer households, in fact, spend a larger relative share of their overall budget in food; a larger relative portion of obese/overweight are from lower income background, and thus buy more unhealthy, cheap food items; and responsiveness to price is typically greater for lower income consumers. This typically leads to argue against the introduction of fat/soda taxes on the ground that they would be regressive in their economic effects.

The counter-argument, however, can be brought forward that the ultimate objective of the 'fat' taxes is precisely to change behavior among the worst off, and that the 'regressivity' on the economic costs would be more than offset by the 'progressivity' in the benefits by such policy intervention. Poorer income households, in fact, have higher sensitivity to price changes, and would therefore be more affected by a change in consumption than higher-income consumers. Moreover, it can be argued, it also depends on where the revenues raised by the fat taxes are going to be spent.

4.4.3. 'Thin' subsidies.

The alternative route of introducing health-related subsidies would of course solve the issue of regressivity. They would also have relevant health benefits. Simulations suggest, for instance, that a 1% subsidy on prices of fruits and vegetables in the US would prevent about 9,700 heart diseases per year (Cash et al., 2005).

'Thin subsidies' however also come with potential disadvantages. In particular, if implemented on their own, they inherently come with income effects, and these may, again, trigger unintended consequences. As for the case of financial incentives, evidence lacks on the comprehensive effects of subsidies on an array of health behaviors over time. Some tentative evidence from specific lab experiments, however, indicates that these income effects can indeed dampen the overall health benefits.

Epstein, Dearing, Roba and Finkelstein (2010), for instance, studied 'thin subsidies' for low-calories-for-nutrient foods in an experiment where a sample of mothers purchased food items for their families. Mothers tended not only to increase their purchases of healthy, subsidized, foods, but also to change their purchases of other types of foods at sale in a way to increase the overall caloric intakes of the foods bought.

4.4.4. 'Fat' taxes *and* 'thin' subsidies?

The above arguments on 'fat taxes' and 'thin subsidies' are the main reasons why the simultaneous introduction of *both* taxes and subsidies has been advocated. A revenue-neutral combination of tax on fats and subsidy on fibers, for instance, would significantly reduce sugar intakes and increase fibers in Denmark (Smed et al., 2007).

More generally, some leading behavioral scientists advocate more comprehensive health policy interventions to deal with the rise of risky behaviours. For instance, Loewenstein (2009) argues that health policy should accompany the introduction of a tax on production and sale of unhealthy foods not only to the subsidization of healthy foods (e.g. vegetables, fruits); but also with a mandatory 'progressive' pricing of junk foods (for instance in terms of calories) in order to stop 'supersizing' by fast food and supermarkets; and with actions aiming at lowering the 'cost' of exercise (for instance, more bike paths, walking children to school, discourage the use of cars, subsidize gym member, or even public transports).

4.5. Nudges

Finally, some 'behavioral' health policies are directly inspired to the idea of 'nudging'. 'Nudges' essentially consist in changes in the choice 'architecture' and the decision environment, designed on the base of behavioral evidence, to trigger changes in behavior occurring at an automatic, or unconscious level. Among the many possible examples, there are the well-known cases of relocating healthy items and unhealthy snacks in the layout of cafeterias or supermarkets; or changing the default option in organ donation statements. Unlike other behaviorally inspired policies discussed above, thus, nudges do not involve any financial incentives or release any new bit of information, and just change the environment where choices and actions are taken.

It is thus a quite broad definition that practically encompasses a vast range of policy interventions levering on human decision biases such as the ones introduced above and many other: status quo and default bias, loss aversion, procrastination, sunk cost fallacy, halo effects, anchoring, overweighting of small probabilities, illusion of control, availability bias, saliency and framing effects, present bias, just to name some (Thaler and Sunstein, 2008; Kahneman, 2011).

4.5.1. 'Nudges' and 'internalities'.

Concerning the behavioral nature of nudges, it is possible to argue that nudges are indeed the cluster of policy interventions that are most genuinely and firmly grounded on 'behavioral' insights. For this reason, 'nudging' health interventions should be regarded as the only group of policies that comfortably sit under the 'umbrella' of 'behavioral', rather than 'conventional', economics. They are, in fact, essentially based on two key 'twin' findings by behavioral economics and applied behavioral science.

First, a great part of human behavior is automatic and non-conscious. This is consistent with the idea that our judgment and decision-making is informed by two cognitive interacting systems: a fast and automatic (non-conscious) system ('System

1') and a slow and deliberative (conscious) system ('System 2') (Chaiken and Trope, 1999; Kahnemanm 2003, 2011).

Second, and related, we often do mistakes and errors in judgment and decision-making, can fall prey to a broad range of biases and influences from environmental cues, and to a large extent may even be unsure of what we actually want. According to the 'behavioral' view, our judgments and 'preferences' are malleable in that they can be affected and shifted, even substantially, by subtle differences in the social environment, the decision frame, the cognitive or visual representations of alternatives. To the extreme, our evaluations and preferences are constructed on the moment in a given situation, and are thus affected by changes in the choice environment. Such shifts and changes can actually occur even when we are not consciously aware of it.

Both ideas are at odds with 'conventional' economics, that is traditionally ingrained with the idea that we make rational deliberations about what is optimal for ourselves given our stable set of preferences, and we then undertake a full and coherent plan of actions. In the long run our actions and decisions thus fluctuate around, and 'reveal', our stable set of preferences, so that we do not make systematic errors and biases. The very core of 'conventional' economics as summarized in 'pillars' 1-2 is essentially about rational deliberative decision-making.

It is mainly on this ground that 'nudging' policies challenge the 'conventional' economics view. Nudges, however, do not *per se* interfere with the sets of options available to individual choice, nor with market mechanisms. Nudges are thus not as 'intrusive' as taxes or subsidies in market mechanisms.

Under the perspective of the different degree of 'intrusiveness' of the health policies, it is possible to establish a parallel between taxes and subsidies, on one side, and nudges, on the other. Fat taxes and thin subsidies, in fact, are levied to deal with the market failures associated to health-related markets, and in particular with the 'externalities' related to food prices. If the aim of the policy is indeed to correct these 'externalities', taxes and subsidies seem the most appropriate 'conventional' economics tools to deal with it.

Nudges, on the other hand, are best employed to deal with 'internalities' (Loewenstein, 2009). Internalities are essentially costs that we impose on ourselves, and that we do not (sufficiently) take into account in our decisions. These 'internalities' costs originate from our own errors and failures in judgment and decision-making, rather than from market failures.

'Internalities' are perhaps a more fundamental source of flaws and failures than 'externalities', as they pre-exist to markets and economic institutions. They also represent a bigger challenge as they cannot be removed by 'conventional' policy tools such as taxes and subsidies: in principle, the 'internal' failures and biases in human decision-making likely survive even when 'externalities' failures are restored by direct market intervention.

This is probably one of the reasons why 'nudging' policies tend to be so highly controversial. It is possible to argue against nudges on the ground that they appear to be manipulative, coercive, or lead to treating citizens as children (Bovens, 2008; Oliver, 2013). Many can be uncomfortable with the idea that 'nudging' consists of manipulations occurring at a non-conscious level. The typical counter-argument is that nudging by 'benevolent' policy makers would attempt to, at best, counteract similar 'manipulating' practices that are routinely employed by the industry from many decades. From this perspective nudging policies can be regarded as a 'countervailing' power on consumers' behalf to the many and powerful 'nudges' by the private sector. The rebuttal is, of course, that also policy-makers can fall prey to errors and biases, and public interventions can result in questionable 'hard paternalism' or 'persuasion' (Glaeser, 2007).

Entering this debate would be completely out of scope for the present review. We instead turn to the key empirical question of whether nudges do work in practice to change behavior. The short answer is that they likely do.

4.4.2. 'Nudging' healthy eating.

Because the application of nudges to public policy-making is relatively recent, it is perhaps premature to draw conclusions on nudges' effectiveness based on systematic reviews of the evidence (Marteau et al., 2011; Loewenstein et al., 2012). The picture gathered by different streams of literature, however, is quite clear in suggesting that even subtle changes in the 'choice architecture' can lead to significant changes in behavior. Below are just some examples, mainly from the 'mindless eating' research by Brian Wansink's team at Cornell University.

Consistently with the well-known story reported in Thaler and Sunstein (2008), simply making the location of fruits and vegetables more salient in high schools' cafeterias, led to 18% increase in actual consumption of foods, and 25% of vegetables (Hanks et al., 2012, 2013).

Also the timing of ordering food in cafeterias is key: in schools were students could pre-order their lunch meals, 29.4% ordered the healthy options compared to 15.3% when preordering was not possible (Hanks, Just and Wansink, 2013): by 'nudging' them to pre-order food when they were in a 'cold' state, students were less likely to fall prey to the tempting sight and smell of unhealthy options when they were in the 'hot' hunger state (Loewenstein, 1996; 2005). Similar types of pre-commitments have been proved successful in activating higher self-control in fast food restaurants (Schwartz et al., 2012).

Moreover, serving food in larger portions led to eating 77% more foods, and 103 more calories, than in smaller portions, without significantly altering feelings of satisfaction or satiety (Van Kleef, Shimizu, and Wansink, 2013). 'Free refill' policy is thus insidious in restaurants: subjects who ate soup from a 'bottomless' bowl that, unbeknownst to them, was attached to a tube underneath the table that was slowly refilling it, consumed 73% more soup (and 140 calories more) than subjects eating from a normal bowl (Wansink et al., 2006).

Similarly, the larger the plate, the smaller we perceive the portions to be, with the result that we serve and eat 16% more when the plates or bowls are larger (Wansink and Van Ittersum, 2006). Even the color of the plate matters: in a buffet, subjects who had low color contrast between their food and the plate they serve themselves on (e.g. tomato sauce spaghetti on a red plate), served themselves 22% (32 grams) more pasta than participants with high color contrast between the food and the plate (e.g. white plate) (Wansink and Van Ittersum, 2012).

In general, we tend to eat less calories when eating intact, fresh food with fibers, skins, and bones, than when consuming processed meals: by taking out all hard parts, food processing, in fact, makes the food softer, and thus easier and quicker to swallow without much chewing (Kessler, 2009). Conversely, the easiness with which fruit can be eaten is crucial: the middle schools were fruit options was presented in slices placed in cups led to a 71% increase in the sales of fruits compared to cafeterias where whole fruit was sold (Wansink et al., 2013).

Smaller packages are key too: subjects who, while watching a show, were given 100-calories packages consumed 25.2% (and 75 calories) less than those given standard 400-calories packages (Wansink, Payne, Shimizu, 2011). Similarly, we eat less when we have visual indicators triggering the idea of stop eating: compared to a group eating all-yellow chips from tubes, subjects ate 50% less chips when, every seventh chips, they encountered a red basil-and-tomato 'divider' chip in between the yellow chips (Gerter et al., 2012).

5. Conclusions.

Across health systems, there is an increasing interest in applying 'behavioral' insights to health policy challenges. Policy-makers have recently discussed a range of diverse health policy interventions that are commonly and quite interchangeably brought together under a 'behavioral' umbrella.

In this review, we propose a taxonomy to classify such 'behavioral' interventions in five 'clusters' of health policies: preferences-based policies; information-based policies; financial incentives; tax- and subsidy-based policies; and nudges.

It is possible to look at these five classes of policies in terms of how far away they move from 'conventional' economics. It can be argued that policies aiming to provide broader sets of choices, more information, to use financial incentives, or to introduce taxes and subsidies (the first four 'clusters') are closer in their conception to 'conventional' than to 'behavioral' economics.

Policies based on the 'nudging' approach are, from this perspective, directly inspired to insights from behavioral economics. 'Behavioral' insights have also been applied to the design of information-based policies and financial incentives.

The most fundamental question is to scrutinize each cluster of policies to assess the existing evidence on its effectiveness. Although more evidence is generally needed, some lessons can already be learned. Preference-based policies aiming to broaden sets of options are practically difficult to evaluate in terms of effectiveness. The main reason is that they rely on the idea that choices and behavior are informed by preferences, but hardly measure preferences as distinct from behavior, and thus fall prey to an 'identification problem'. Information-based policies essentially fail to lead to significant and sustained behavioral change, although they can raise awareness. Financial incentives lead to immediate changes in behavior in the envisaged direction. There is no conclusive evidence, however, that purely monetary incentives lead to sustained change in behavior for periods of time longer than 6-8 months.

Moreover, both ‘pure’ information release and ‘pure’ financial incentives can trigger unintended ‘perverse’ effects that lead to partly, or completely, offset the initial change in behavior. The unambiguously successful incentive and information-release schemes are mostly the ones directly inspired to, and designed on, ‘behavioral’ insights. Consistently with the ‘asymmetric’ or ‘libertarian’ paternalism approach, these policies lever on our own biases to help us to make better choices.

On a purely conventional economics ground, both ‘fat taxes’ and ‘thin subsidies’ present important caveats. Fat taxes have regressive effects, while thin subsidies triggers income effects which can then feed into compensatory effects. Despite no country has yet introduced them systematically, there are good reasons to believe that the simultaneous and comprehensive introduction of both fat taxes and thin subsidies would potentially be able to correct, at least partly, the ‘externalities’ in some health-related markets.

Furthermore, although it is premature to assess the overall effectiveness of the ‘nudging’ approach, policies aiming to change the ‘choice’ architecture based on behavioral science insights, have a high potential to successfully change behavior, mainly at an automatic and unconscious level.

All in all, the available evidence suggest that, while policies genuinely inspired to behavioral economics are successful to solve ‘internalities’ failures, they are unlikely to effectively deal with all ‘externalities’ and market failures associated to health behavior. In order to curb risky behaviors, ‘behaviorally’ inspired policies should accompany more ‘conventional’ economics interventions, such as taxes, subsidies, and other forms of regulation.

Finally, although randomized controlled experiments are not a distinguishing feature of behavioral economics, their growing employment by policy-makers should be welcome for testing, assessing, and fine-tuning health policy interventions. In particular, the use of a broad spectrum of randomized experiments spanning from the lab to the field should be advocated as a powerful toolkit for finding out what works and what does not work in practice. Whether ‘behavioral’ or not, the insights from these experiments, and the openness to apply them to the design of health policies, can represent the beginning of a revolution.

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Appendix: Figures

Figure 1. A taxonomy of ‘behavioral’ health policies