


ARTICLE

Internal barriers to efficiency: why disinvestments are so difficult. Identifying and addressing internal barriers to disinvestment of health technologies

Bjørn Hofmann^{1,2} 

¹Institute for the Health Sciences, Norwegian University of Science and Technology, Gjøvik, Norway and ²Centre of Medical Ethics, University of Oslo, Oslo, Norway

Corresponding author. Email: bjoern.hofmann@ntnu.no; b.m.hofmann@medisin.uio.no

(Received 6 October 2020; revised 6 December 2020; accepted 6 January 2021; first published online 10 February 2021)

Abstract

Although efficiency is a core concept in health economics, its impact on health care practice still is modest. Despite an increased pressure on resource allocation, a widespread use of low-value care is identified. Nonetheless, disinvestments are rare. Why is this so? This is the key question of this paper: why are disinvestments not more prevalent and improving the efficiency of the health care system, given their sound foundation in health economics, their morally important rationale, the significant evidence for a long list of low-value care and available alternatives? Although several external barriers to disinvestments have been identified, this paper looks inside us for mental mechanisms that hamper rational assessment, implementation, use and disinvestment of health technologies. Critically identifying and assessing internal inclinations, such as cognitive biases, affective biases and imperatives, is the first step toward a more rational handling of health technologies. In order to provide accountable and efficient care we must engage in the quest against the figments of our minds; to disinvest in low-value care in order to provide high-value health care.

Key words: Bias; disinvestment; efficiency; imperative; low-value care; rationality; reassessment

1. Introduction

Efficiency is a core concept in health economics. However, this is not pervasive in practice. For example, health economists are accused of focusing on adoption rather than efficiency when assessing health technologies (Scotland and Bryan, 2017). The lack of efficiency is expressed by an increased focus on low-value health services (Parkinson *et al.*, 2015; Brownlee *et al.*, 2017; Elshaug *et al.*, 2017; Glasziou *et al.*, 2017; Saini *et al.*, 2017a, 2017b; Malik *et al.*, 2018). Recommendations from NICE (Do-not-do list), Choosing Wisely and from Australia (Elshaug *et al.*, 2012) together identify 1350 specific low-value technologies in use (Soril *et al.*, 2018). A series of drivers of poor medical care have been identified (Hollingworth and Chamberlain, 2011; Elshaug *et al.*, 2012; Niven *et al.*, 2015; Scott and Duckett, 2015; Saini *et al.*, 2017a, 2017b) and solutions are suggested (Ibargoyen-Roteta *et al.*, 2010; Garner and Littlejohns, 2011; Schmidt, 2012; Levinson *et al.*, 2015; Pathirana *et al.*, 2017; Scotland and Bryan, 2017; Soril *et al.*, 2017; Harris *et al.*, 2017a, 2017b).

In particular, disinvestments have been strongly encouraged in order to reduce low-value care and increase efficiency (Ruano-Ravina *et al.*, 2007; Hollingworth and Chamberlain, 2011; Elshaug *et al.*, 2012; Gliwa and Pearson, 2014; Schwartz *et al.*, 2014; Selby *et al.*, 2015; Gapanenko *et al.*, 2017; Iacobucci, 2018; Prusaczyk *et al.*, 2020).

Although assessment supports decisions about adopting technologies, disinvestment decisions require that technologies already in the system undergo reassessment (or assessment if they were

not initially subject to an assessment). However, reassessments are rarely reported compared to assessment of new technologies (Soril *et al.*, 2018) and very few results from disinvestments are documented (Polisena *et al.*, 2013; Scott and Elshaug, 2013; Alderwick *et al.*, 2015; Coronini-Cronberg *et al.*, 2015; de Vries *et al.*, 2016; Harris *et al.*, 2017a, 2017b). Why is this so? This is the key question this paper seeks to address. Although there may be many rational explanations for why reassessments and disinvestments are so rarely reported, this paper addresses some of the less rational mechanisms and barriers. A wide range of barriers (and facilitators/enablers) for disinvestments have been identified (Solomons and Spross, 2011; Henshall *et al.*, 2012; van Bodegom-Vos *et al.*, 2017; Harris *et al.*, 2017a, 2017b; Sauro *et al.*, 2019). However, these are mainly rational or system-level phenomena, such as lack of guidelines, lack of evidence or competency and lack of support (Harris *et al.*, 2017a, 2017b). Even if we address all such barriers, there are still some crucial less rational obstacles that effectively can obstruct efficiency in health care, such as affective biases, cognitive biases and imperatives of our imaginations.

Accordingly, this paper will investigate whether there are, strong, ‘internal’ and not fully recognized mechanisms behind the continued use of low-value care. The overall goal is to bring health economics, health technology assessment (HTA), and health policy making consistent with its principles. Hence, although several studies have provided external (system-level) explanations, this study will contribute by looking inside us at cognitive biases, affective biases and imperatives. The goal with revealing the figments of our mind that undermine or hamper reassessment and disinvestment is to increase our attention and direct our actions toward more effective measures to fight the lack of efficiency.

Before analyzing the mechanisms of our mind that hamper disinvestment, let us start with clarifying what is meant by mechanism and disinvestment, the relationship between reassessment and disinvestment and the relationship between the micro-level mechanisms and macro-level decisions.

2. Initial clarifications

In this paper, the term ‘mechanism’ is used as a generic term for a wide range of dispositions, inclinations, biases, tendencies, imperatives and forces that hampers disinvestment.

Disinvestment is defined as ‘withdrawing health resources from any existing health care practices, procedures, technologies or pharmaceuticals that are deemed to deliver little or no health gain for their cost, and thus do not represent efficient health resource allocation’ (Elshaug *et al.*, 2008) and as activities that ‘remove a TCP [technology and clinical practice] that is unsafe or ineffective, restrict a TCP to more appropriate patient groups, or replace a TCP with an equally safe and effective but more cost-effective option’ (Harris *et al.*, 2017a, 2017b). The ‘withdrawal of health resources’ is frequently considered to be negative (despite the fact that what is withdrawn is of little, no, or even negative value). Moreover, the prefix (*dis*) means ‘apart’, ‘under’, ‘away’ or ‘negative’. Hence, there is a negative connotation related disinvestment.

Disinvestment of low-value care is in accordance with basic principles of efficient use of health resources (Scotland and Bryan, 2017). In principle, reassessments and disinvestments can have positive or neutral connotations, for example when identifying scope creep and appropriateness of care (distinguishing high-value and underused procedures from low-value or overused procedures). Nonetheless, the concept tends to be associated with reduction, removal or withdrawal, therefore obtains a negative nuance. Hence, the conception of disinvestment is itself subject to the biases to be discussed below.

Many of the mechanisms that hamper disinvestment also are relevant for reassessment.¹ Reassessment is also a precondition for identifying low-value care and candidates for

¹Reassessment is defined as ‘a structured, evidence-based assessment of the clinical, social, ethical and economic effects of a technology currently used in the healthcare system to inform optimal use of an existing technology in comparison with its alternatives’ (Noseworthy and Clement, 2012: 201). Although reassessment can result in increased as well as decreased uptake

disinvestment. Hence, the mechanisms hampering disinvestment also hinder reassessment. However, in order to simplify the reading of the text the paper will use the term ‘disinvestment’ and not ‘reassessment and disinvestment’.

Moreover, the following analysis focuses on mechanisms that appear at the level of individuals and it is not obvious that such mechanisms have system-level effects. However, there are at least three reasons why individual-level mechanisms have system-level effects. First, even micro- and meso-level mechanisms have macro-level implications, not least in terms of alternative costs. Second, many of the described mechanisms are relevant for individuals involved in disinvestment deliberation, including health policy makers. Third, disinvestment decisions have to be performed at the practical (meso- and micro-) level where the effects are most noticeable. Rational and unbiased disinvestment decisions at the macro level will have no real-world effect if they do not take the micro-level effects into account. Moreover, a more detailed analysis of the levels that the various mechanisms work is provided in Hofmann (2020) and the levels are indicated in Table 1.

3. Mechanisms that hamper disinvestment

There are many ways to classify or group the various inclinations that will be discussed in the following. As the writings of Kahneman and Tversky have been so influential, their (system 1) framework will be applied to describe cognitive biases and affective/emotional biases (Kahneman *et al.*, 1982). However, as some of the mechanisms that will be discussed appear to fit well neither with system 1 nor system 2, the concept of ‘imperative’ discussed by Mazarr will be applied (Mazarr, 2016). An *imperative* is defined as a ‘specific form of nonconsequentialist judgments [which] involves following, without much analysis or rigorous thought, an intensely felt requirement or obligation that creates a sense that the [agent] ‘must’ take some action’ (Mazarr, 2016). As biases and imperatives may need different analytical and practical approaches, it makes sense to try to differentiate between them.

Table 1 gives an overview of the groups and specific biases identified in this study.

3.1 Cognitive biases

The Status Quo Bias is described as a *cognitive bias* with an irrational preference for one option only because it preserves the current state of affairs (Kahneman and Tversky, 2013). This links to what has been called aversion to change (conservatism) making people avoid change (Saposnik *et al.*, 2016). Hence, as far as disinvestments imply changes, they can make people skeptical or resentful.

Another bias is found in our tendency to understand risks and benefits in very unbalanced ways (Slovic and Peters, 2006; Slovic, 2016). The risks of low-value technologies may be underestimated while the benefits may be overestimated, making disinvestment seem counterintuitive or unnecessary. Hence, when we assess technologies we may not always understand and assess them in an unengaged way (Gigerenzer, 2015).

Another well-known bias is the ‘endowment effect’ according to which we tend to overvalue what we already have got compared to alternatives. In economic terms: ‘the fact that people often demand much more to give up an object than they would be willing to pay to acquire it’ (Kahneman *et al.*, 1991). Hence, the technology that we have assessed and implemented, been trained to use, become familiar with, and which partly constitutes our professional identity, tends to be valued higher than other technologies; even if evidence shows that the alternative

and use of a given health technology, and despite the fact that this has been repeatedly emphasized by experts in the field (Noseworthy and Clement, 2012: 201–202; MacKean *et al.*, 2013), there seems to be a strong presumption that reassessment is related to reduced use, removal, rationing and decommissioning (Noseworthy and Clement, 2012: 201–202; Soril *et al.*, 2017). Hence, reassessment also has a connotation of negative psychological value – of taking away.

Table 1. Overview of various mechanisms undermining reassessment and disinvestment

Type of mechanism	Mechanism (bias/imperative)	Short description	Level
Cognitive biases	Status quo bias/aversion to change	‘What we have is better than what we will get’	All
	Risk perception bias	Underestimating risk and overestimating benefits	Micro, meso
	Positive feedback loops	Technology use is self-reinforcing	All
	Anchoring effect	What you have sets the standard/reference	All
	Framing effect	We decide on options based on the way they are presented (e.g. with positive or negative connotations)	All
	Information bias	Bias due to misclassification	Micro, macro
	The endowment effect	Overvaluing what we have, tendency to retain an object	All
	Loss aversion effect	Disliking to reduce or loose things or services	All
	Aversion to risk and aversion to ambiguity	Disliking risk and/or uncertainty	All
	Better to be safe than sorry, anticipated decision regret, fear aversion, asymmetry	Acting out of fear for the consequences of not doing anything. Fear of doing too little > fear of doing too much	Micro, meso (mainly)
Affective/emotional biases	Rejection dislike	Disliking rejecting demands or requests	All
	Taking away dislike	Disliking to take/taking things or services away	All
	Failure embarrassment, integrity, self-conception	Disliking to admitting that ineffective services have been provided	All
	Status and prestige of diseases, specialties and technologies	Preferring diseases, services or technologies due to their status or prestige	Micro, meso (mainly)
	Imperative of action/imperative of possibility, Roemer’s law	Action is better (and more integrity promoting) than inaction (<i>ut aliquid fiat</i>). Because something <i>is</i> possible, it should be implemented. ‘A built bed is a filled bed’	All
	Technological placebo effect	Health outcome due to expectations or belief in technology	Micro (primarily)
	Status and prestige of diseases, specialties, and technologies	Preferring diseases, services or technologies due to their status or prestige	Micro (primarily)

(Continued)

Table 1. (Continued.)

Type of mechanism	Mechanism (bias/imperative)	Short description	Level
Imperatives	Imperative of progress	Progress is a good thing (value) in itself. ‘New is better than old’	All
	Imperative of complexity	‘Advanced is better than simple’	All
	Imperative of extension	‘More is better than little’	All
	Positive feedback loops	Technology use is self-reinforcing	All
	Information imperative of knowledge	Knowledge (testing) is better than ignorance	Micro (primarily)
	White elephants	Technologies acquired to attract or suit specific persons or groups that are not (or hardly) used	Micro
	The boys and toys effect	Technologies attractiveness to professionals and patients (‘the cool gadget effect’)	Micro

technology is better. The endowment effect relates to ‘rejection dislike’ and ‘failure embarrassment’ (see below).

Certainly, there are other cognitive biases relevant for reassessment and disinvestment such as the anchoring effect, framing effects and information biases (Saposnik *et al.*, 2016) (see Table 1). Common to all these (and several other) biases is that they tend to buttress positive views and use of a given technology, hampering disinvestment.

3.2 Affective biases

In addition to these cognitive biases, other biases are frequently classified as affective, as emotional factors that tend to distort cognition and decision making. One example is the ‘loss aversion’, according to which we feel uncomfortable with losing what we have, or in economic terms ‘the disutility of giving up an object is greater than the utility associated with acquiring it’ (Kahneman *et al.*, 1991). This is exactly what we may fear is happening when we reassess or disinvest in (health) technology. By disinvestment, we think we lose something, e.g. because we attribute unreasonable value to what we have. This also relates to the endowment effect (above).

Other related psychological effects are ‘anticipated decision regret’ (Tymstra, 1989) and ‘better safe than sorry’. For example, the fear of doing too little may be greater than the fear of doing too much – the fear of ignoring dominates the fear of exaggerating (aversion asymmetry). This effect may enhance the fear of reducing, taking something away or disinvesting. It is also related to defensive medicine and what has been called the ‘popularity paradox’ (Raffle and Gray, 2007; Welch and Black, 2010). ‘Aversion to risk’ and ‘aversion to ambiguity’ (Saposnik *et al.*, 2016) may also be at play whenever it feels risky to reassess or disinvest. The key point for these types of biases is an emotional fear of not being sure, doing too little and not being professionally proficient.

A related bias has been called ‘rejection dislike’ and stems from the fact that no one likes being rejected or to reject others. The same goes for the emotional distress with taking something away (taking away dislike). Disinvesting in specific technologies may mean that some services previously provided may have to be removed. Hence, some patients cannot get what they previously have been offered, and despite the fact that it is of low value, it feels bad to take it away and thereby rejecting people (or to lose it). This may therefore explain the resistance to reassessment and disinvestment.

Correspondingly, no one likes to admit having behaved foolishly. Disinvesting (and sometimes also reassessing) a technology implies that we have provided patients with low-value care, which is not compatible with the professional integrity and self-conception of many health professionals (or policy makers). This may be called the ‘failure embarrassment effect’, and can be one of many reasons why clinicians, health managers, as well as health decision makers are modestly enthusiastic for disinvestment.

Hence, as far as disinvestment is associated with losing, rejecting, taking away or having behaved foolishly, we tend to be inclined to avoid such situations. This can help us to explain our moderate enthusiasm for reassessment and disinvestment, but also how we should avoid such aspects in order to facilitate reassessment and disinvestment.

3.3 Imperatives

One important imperative is the imperative of possibility (Hofmann, 2002a, 2002b, 2002c): because something *is* possible, it *ought* to be implemented, or as they say in radiology: ‘we scan because we can’. This is closely related to Roemer’s law: ‘A built bed is a filled bed’ (Shain and Roemer, 1959). The imperative of possibility is related to another imperative, which expressed by the traditional medical phrase *ut aliquid fiat* (that something must happen), i.e. that there is an obligation to act, and that action is better than inaction. Technology is associated with actionability and reducing readiness to action can be conceived of as plummeting

professional stamina. This phenomenon can be connected to the tendency to use *technology as a placebo* (Einvik *et al.*, 2002; Saririan and Eisenberg, 2003; Harris, 2016). For example, diagnostic technology that is developed to detect *somatic disease* is used to treat *mental* conditions (anxiety) or to ascertain *health* (Hofmann, 2002a, 2002b, 2002c, 2006). This sometimes is called ‘technology creep’ (Gelijns and Halm, 1991; Hobson, 2009). As the placebo-effect of technology is high its overall effect may be considered to be significant even if documented (placebo-controlled) effect may be small (Howard *et al.*, 2005). This may explain the use of a wide range of low-value care, including several kinds of surgery (Harris, 2016) and the opposition to disinvestment.

This relates to the imperative of progress (sometimes also called progress bias), according to which we have a strong cognitive propensity to progress and development (Hofmann, 2019a, 2019b). Initially, one could come to think that experience and belief in progress would promote change, leaving old technologies obsolete when embracing new ones. However, there tends to be an accumulative aspect of the *imperative of progress*. Implicitly, we tend to think that science in general and medicine in particular progresses by adding new technologies, not by reducing or removing old ones. Expansion and addition are part and parcel of progress.

Furthermore, the *imperative of progress* can be connected to technology-related tendencies, such as strong beliefs in positive outcome of advanced technologies (Anton and Jones, 2017; Greenhalgh *et al.*, 2017) and what has been described as a technology ‘adoption addiction’ (Scotland and Bryan, 2017) and the ‘denial of the need for disinvestment’ (Bryan *et al.*, 2014). It can also be related to the tendency to use technology for other purposes than intended without documentation of outcomes. Again, diagnostic imaging is a good example, where diagnostic technology is used therapeutically to treat fear and health anxiety, and sometimes to treat mental conditions in physicians (litigation anxiety).

Relatedly, we tend to think that advanced systems and technologies are better than simple ones, a phenomenon that can be called ‘imperative of complexity’ (sometimes also called ‘complexity bias’). A great number of technologies identified as low-value care are advanced or hi-tech, and it apparently counters our intuition that these advanced technologies could be ineffective, inefficient or even harmful. On the contrary, lo-tech or what has been called ‘reverse innovation’ (adapting simple but efficient solutions from low- or middle-income countries) has very little traction.

Yet, another connected imperative is the *imperative of extension* (sometimes also called extension bias). According to the imperative of extension more is better than little (Rank, 2008). This can be observed in a variety of fields, e.g. ‘more tests are better than few’. Reassessing (with the prospect of reducing) and disinvesting in technologies certainly breaks with basic intuitions that more is good.

The imperatives of progress and extension can be observed in the use and management of medical technologies in everyday clinical practice, for example in what has been called double (multiple) replacement (Hofmann, 2019a, 2019b): an ultrasound machine is ‘replaced’ because it ‘provides low quality images’, ‘is dangerous’ or ‘outdated’. However, when the replacement arrives, the old machine is kept as a reserve. After a while, the discarded machine enters the daily practice again, for example due to high demand. After some time, it is argued again that it is ‘provides low quality images,’ ‘is dangerous’ or ‘outdated’ and needs replacement again (Hofmann, 2002a, 2002b, 2002c). Accordingly, disinvestment counters these types of ingrained practice partly driven by imperatives.

Furthermore, there are a series of positive cognitive feedback loops in the assessment and handling of medical technologies. For example, increasing the accuracy of diagnostic tests may lead to the detection of milder cases, and treating milder cases will increase the success rate (Black and Welch, 1993; Hofmann, 2006; Welch *et al.*, 2011). Any measures that counter this experience of success appear counterintuitive, ‘irrational’, and regressive.

Diseases and technologies are also well known to have different status and prestige. In particular, diseases and specialties where advanced technology is applied have higher prestige than those

where such technologies are not applied (Album and Westin, 2008; Album *et al.*, 2017). This may be because technology is related to innovation, progress, action, control and optimism (Fredriksen, 2006; Haas *et al.*, 2012; Greenhalgh, 2013; Strand *et al.*, 2016). This in turn may spur certain obligations (imperatives) to contribute to the progress of the field.

One imperative that also can counter disinvestment is what has been called *the imperative of knowledge*. In the field of diagnostics this is expressed as ‘to know is better than not to know’ despite the fact that many diagnostic tests have many false positives, incidental findings and over-diagnosis, so that the risks outrun the benefits. Nonetheless, we want to know, and tend to think that early detection is better than late (Hofmann and Skolbekken, 2017).

Another example is what has been called ‘white elephants’,² i.e. technologies that are acquired in order to attract skillful professionals, to keep individual professionals satisfied or to entice patients, but where the technology may not add value (or be of low value) to patients’ outcomes (Hofmann, 1998).

This relates to what has been called the ‘boys and toys effect’ where technologies, such as surgery robots, have been implemented not because of their effectiveness or efficiency, but because of their attractiveness to professionals and patients (Abrishami *et al.*, 2014). The extensive use of Swan-Ganz catheters may be another example (Chatterjee, 2009). This mechanism can be related to the fact that the requirements for documented effectiveness and efficiency has been different for devices than for drugs (Wilmshurst, 2011).

Hence, we may become reluctant to counter such imperatives, e.g. disinvesting and disposing of technologies that are associated with progress, action, knowledge, control and prestige. Thus, such tendencies are less immediate than biases (system 1) but less reflective than system 2 thinking (being non-consequentialist), and have therefore been classified as imperatives (Mazarr, 2016).

In sum, there are cognitive biases, affective biases and imperatives that undermine or obstruct efficiency in health care. Table 1 gives an overview of the mechanisms that have been discussed in this paper and which level it involves.

4. Implications: what do biases and imperatives do?

The identified mechanisms can hamper or undermine disinvestment and thereby efficiency in health care. They can therefore help to explain why there are so few attempts and negligible outcomes from disinvestment, despite its excellent rationale, available evidence, accessible frameworks and available guidance. It also explains why identified low-value care still seems abundant, despite high pressure on resources and clear requirements of efficiency.

Another implication is skewed or unwarranted priority setting. The identified inclinations, i.e. the cognitive biases, affective biases and imperatives, represent a kind of implicit rationing resulting in effective and efficient technologies not being implemented or applied (due to opportunity cost) (Hofmann, 2020).

What about distrust and disillusion, frequently following from unaccountable health care? Does the inefficient health service provision following from biases and imperatives result in disillusion or distrust? No. Inefficient care resulting from lack of disinvestment hardly fosters distrust in care. On the contrary, disinvestment can frustrate health professionals and ‘denying patients care’ can harm the patient–physician relationship as well as trust in the health care system. Accordingly, ordinary self-correcting mechanisms do not work.

One important implication is that HTA bodies, guideline developers and health policy makers need to take biases and imperatives into account when they develop and apply their strategies to change health care toward more efficient and just health services provision.

²The term ‘white elephants’ stems from South-East Asia, where white elephants were considered to be holy, and thus neither could work nor be killed.

5. What can we do?

How then, should we overcome these barriers to disinvestment as they are internal and irrational mechanisms and not external system-level barriers (rational or interest-driven)?

The first lesson learnt from the analysis is that many of the mechanisms are hidden and not acknowledged. Several of the biases are related to the fast and intuitive system 1, which is hard to access and alter. The best we can do is to engage the more reflective system 2 (Kahneman and Tversky, 1977; Kahneman and Tversky, 1996; Saposnik *et al.*, 2016). This is slower and more resource demanding and also explains why many of the system level facilitators may not be very effective for biases and imperatives.

A first step would be to make explicit the implicit and make covert mechanisms overt. Engaging professionals in explaining why they provide low-value care and patients why they demand it can be but one way to do so. In this process, it may be important to inform openly about why a technology is considered for disinvestment.

Demonstrating the low value compared to relevant alternatives of higher value, can be helpful.

In order to avoid loss aversion, the endowment effect, and other biases it can be fruitful to explain and underscore the (potential) gain with disinvestment. Estimate and report the opportunity cost of low-value care and alternative high-value care can thus be helpful.

Moreover, asking specific questions targeting the various mechanisms may be fruitful. For example, do the fears to doing too little dominate over the fears of doing too much?

Another strategy is to appeal to professional integrity as well to basic ethical principles, such as non-maleficence. The world-expanding ChoosingWisely campaign is but one example of how this can work. Moreover, rejecting and removing a technology is only bad if the technology is of real value to the patient(s). Educating professionals, health managers, policy makers and patients in critical thinking may be important. Hence, involving them in disinvestment processes may be wise (Daniels, 2016).

Imperatives as well as professional norms, and values are ingrained and frequently discussed explicitly. There may be few forums or opportunities to address them. Hence, to initiate, stimulate and engaging professionals to reflect on their imperatives when they are deliberating on health technologies may be fruitful. For example, one can ask professionals to explain how they are addressing the identified imperatives. One can also scrutinize to what extent the condition, the profession(s), specialty, patient group or the technology has prestige or symbolic value, which gives it unwarranted attention, use or priority.

Correspondingly, professionals can be engaged in reflection on how they think the mechanisms influence their professional integrity and standing, and how they could be adjusted. Moreover, as professional norms and values are conveyed and formed most efficiently by opinion leaders, it appears important to target and engage them.

The barriers to disinvestment are oftentimes ingrained behaviors not identified or discussed openly. Hence, explicitly to address the mechanisms may be revealing and influence attitudes and behavior.

Figure 1 shows a flowchart that may be useful for the very first step of addressing biases and imperatives. The next step will be to target and tailor approaches to the disinvestment of specific technologies. There exists a plethora of frameworks of interventions for behavioral change, all with their pros and cons (Michie *et al.*, 2011). Gladly, the literature provides theoretical constructs (Michie *et al.*, 2005) and practical guidance (Michie *et al.*, 2011).

6. Discussion

There are more than 150 biases identified in a number of fields in the literature (Wright and Bragge, 2017). Even though, not all of these may be relevant for handling health technologies, several significant mechanisms have not been mentioned specifically. For example, social pressures (bandwagoning) frequently studied in human relations may be relevant (Cantarelli *et al.*, 2020).

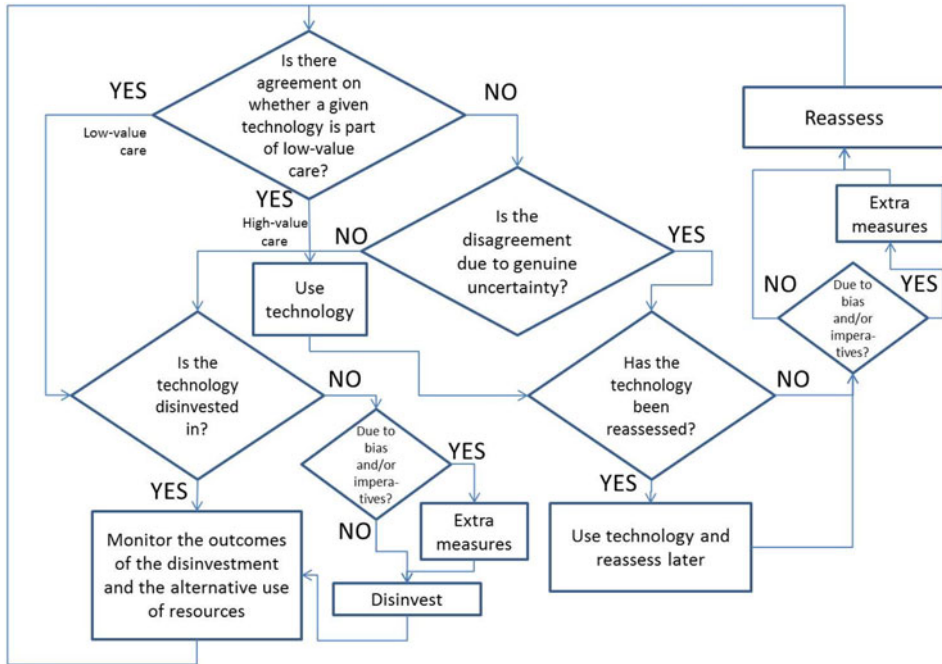


Figure 1. Flowchart of questions with respect to addressing reassessment and disinvestment.

The same goes for context errors that are well known from clinical decision making, e.g. when the physician is not able to see the context of the patient’s condition and makes erroneous diagnostic or therapeutic judgments (Wright and Bragge, 2017). Other psychological effects may also obstruct health economics’ objective of efficient care, such as singularity effect and taboo-tradeoffs (Tinghög and Västfjäll, 2018). Abstract measures of efficiency lose their relevance in the face of one suffering person or when trading off peoples’ lives against consumption.

However, the point here has not been to provide an exhaustive list of biases, but to attend to biases where examples indicate that they hamper disinvestment. Correspondingly, the goal has not been to go into the diverse and detailed debates on the classification and relationship between human cognitive, conceptual and affective biases (or imperatives), but rather to point to some mechanisms that appear to be relevant for explaining and handling the apparently irrational rejection of disinvestment. There may be many ways of classifying the various human inclinations. As indicated earlier, the classification here follows classification in psychology and behavioral economics as that may give some indications of how to address the biases.

Similarly, the mechanisms that have been described can be classified in many ways. For example, imperatives may be classified, analyzed and explained in a wide range of other ways, e.g. as inertia (Okonofua *et al.*, 2006; Cooke *et al.*, 2012; Reach *et al.*, 2017; Saposnik and Montalban, 2018), human deficiencies (Cassell, 1993) or more specific forms of technological imperatives (Wolf and Berle, 1981; Mandell, 1983; Barger-Lux and Heaney, 1986; Hofmann, 2002a, 2002b, 2002c). Correspondingly, the loss aversion effect here classified as an affective bias may well be classified as a cognitive bias. This is perfectly fine, as the point has not been to provide a perfect typology or nomenclature, but to focus on the mechanisms in order to increase awareness of phenomena that hamper reassessment and justified disinvestment.

As clarified in the Introduction, other barriers and obstacles than those identified and analyzed here have been identified in the literature, e.g. system-level barriers and that large-scale changes are required even to make small disinvestments in low-value care (Willson, 2015).

The reason for this is that low-value care frequently affects large parts of the system (pervasiveness), that new or alternative models are different from current ways of thinking and doing (depth), and that a change has to be spread across geographical boundaries, organizations or distinct groups of people (size) (Willson, 2015). The focus of this study has been to add to the existing literature on the external system-level barriers by reviewing internal individual level obstacles. However, although biases and imperatives are ‘internal’ in actors, they are active in all stakeholders, and are based on social interaction, i.e. they are intersubjective. Moreover, there are connections between internal and external factors. For instance, industry is benefiting from and promoting biases, such as the imperative of progress. Moreover, biases and imperatives are related to interests and drivers. The closer analysis of the connection between the internal biases and external aspects and agents is the topic for another paper.

It is also worth noting that the health care system may have many other goals than efficiency, e.g. that individuals are cared for and maintaining trust. This is perfectly fine. This paper has only presupposed that efficiency is one of the goals warranted by the ethical principle of justice.

Moreover, there are many types of disinvestments (Daniels *et al.*, 2013). To investigate which type of mechanism is more efficient in undermining specific types of disinvestment is beyond the scope of this study. This should be considered to be the first step to address the inner barriers to reassessment and disinvestment. Similarly, disinvestments come in many forms, e.g. in ways that are not documented or evidence-based. Services are closed and activities terminated. However, such types of disinvestments have not been the topic of this paper.

Correspondingly, this study is not comprehensive with respect to covering measures to bar or reduce the mechanisms that hamper warranted disinvestment. Obvious measures such as highlighting the positive aspect of (a) gaining knowledge of the benefits of a technology (through reassessment) and (b) the positive aspects of reducing low-value care in order to promote high-value care have only been alluded to. Specific suggestions to reduce cognitive biases exist within special fields, such as decision support to reduce diagnostic errors (Newman-Toker and Pronovost, 2009; Lee *et al.*, 2013; McDonald *et al.*, 2013) and interventions to improve clinical reasoning and decision-making skills (Graber *et al.*, 2012). Advice on de-biasing health decisions in the clinical setting are available (Wilson and Brekke, 1994; Croskerry *et al.*, 2013a, 2013b), and several of these may be relevant for the health policy context, such as ‘stopping rules’, checklists and ‘cognitive forcing strategies’. All measures need to be carefully analyzed. Specifically, they need to be assessed with respect to biases and imperatives. Again, this study is the first step, pointing to basic measures to address the identified and inherent barriers to disinvestment.

One basic philosophical question emerges from the results of this study: do the biases and imperatives distorting rational disinvestment promote paternalism or libertarian paternalism (nudging)? This crucial question is beyond the scope of the current study. First, because it requires clarification of a series of empirical premises, e.g. how prevalent and intractable biases and imperatives are. Second, because it is the topic of a study (program) in itself.

Moreover, the study has focused on disinvestment. Other and related concepts could have been studied as well, such as reduced use, removal, decommissioning, withdrawal and rejection of technology as well as obsolete, outmoded or superseded technologies. The relationship between these and disinvestment are certainly of great interest, but beyond the scope of this study. As pointed out in the Introduction, most of the mechanisms discussed for disinvestment are relevant for reassessment. A more detailed analysis of the relevance of the various types of biases and imperatives would be a next step in the study of internal factors hampering efficient health care.

Another important issue that is not covered here is the fact that the mechanisms can be placed within specific theoretical frameworks. For example, many of the mechanisms can be elaborated from conceptual-metaphorical theory (Lakoff and Johnson, 1999), which may have implications on how we may address them. Again, theoretical framing is beyond the scope of this study, despite being interesting and important.

The preliminary measures are not to replace other suggestions for increasing efficiency (Ibargoyen-Roteta *et al.*, 2010; Garner and Littlejohns, 2011; Schmidt, 2012; Levinson *et al.*, 2015; Pathirana *et al.*, 2017; Soril *et al.*, 2017; Harris *et al.*, 2017a, 2017b) but rather to supplement and enhance the effectiveness of already existing suggestions.

7. The Mae West Hypothesis

This study has identified three classes of mechanisms that undermine or hamper disinvestment and reassessment: cognitive biases, affective biases and imperatives. The flowchart provides questions to ask and specific actions. The overall goal is to bring technology management on par with basic principles in health economics and in health care in general and to contribute to a more rational handling of technology in health care. At present, we tend to be subject what may be called ‘the Mae West Hypothesis (MWH)’, i.e. the belief that too much technology is a good thing. Mae West allegedly claimed that ‘Too much of a good thing is wonderful’ (Johnson, 1982; Hofmann, 2010). However, with a significant extension of low-value care, the MWH is false, and given a potentially high opportunity cost of low-value care, it is dangerous.

8. Conclusion

The DIS – in *disinvestment* (and the RE – in *reassessment*) enhances the negative connotations due to internal mechanisms, such as cognitive biases, affective biases and imperatives. They tend to undermine basic principles in economics and priority setting and, therefore, should be conquered.

In order to do so, we must shrewdly identify, critically assess and bravely handle the inclinations of our mind. In particular, we must abandon the belief that too much of a good thing is wonderful. Hence, to provide accountable and efficient care we must engage in the quest against the figments of our minds. We must reassess and disinvest in order to exchange low-value care with high-value health care.

Acknowledgement. I am most thankful for the wise comments and constructive suggestions from anonymous reviewers.

Conflict of interest. I certify that there is no conflict of interest in relation to this manuscript, and there are no financial arrangements or arrangements with respect to the content of this manuscript with any companies or organizations. The work is funded by ordinary university salary.

References

- Abrahami P, Boer A and Horstman K** (2014) Understanding the adoption dynamics of medical innovations: affordances of the da Vinci robot in the Netherlands. *Social Science & Medicine* (1982) **117**, 125–133.
- Album D and Westin S** (2008) Do diseases have a prestige hierarchy? A survey among physicians and medical students. *Social Science & Medicine* (1982) **66**, 182–188.
- Album D, Johannessen LE and Rasmussen EB** (2017) Stability and change in disease prestige: a comparative analysis of three surveys spanning a quarter of a century. *Social Science & Medicine* (1982) **180**, 45–51.
- Alderwick H, Robertson R, Appleby J, Dunn P and Maguire D** (2015) ‘Better Value in the NHS.’ *The Role of Changes in Clinical Practice*. London: Kings Fund.
- Anton MT and Jones DJ** (2017) Adoption of technology-enhanced treatments: conceptual and practical considerations. *Clinical Psychology: Science and Practice* **24**, 223–240.
- Barger-Lux MJ and Heaney RP** (1986) For better and worse: the technological imperative in health care. *Social Science & Medicine* (1982) **22**, 1313–1320.
- Black WC and Welch HG** (1993) Advances in diagnostic imaging and overestimations of disease prevalence and the benefits of therapy. *New England Journal of Medicine* **328**, 1237–1243.
- Brownlee S, Chalkidou K, Doust J, Elshaug AG, Glasziou P, Heath I, Nagpal S, Saini V, Srivastava D and Chalmers K** (2017) Evidence for overuse of medical services around the world. *Lancet* **390**, 156–168.
- Bryan S, Mitton C and Donaldson C** (2014) Breaking the addiction to technology adoption. *Health Economics* **23**, 379–383.
- Cantarelli P, Belle N and Belardinelli P** (2020) Behavioral public HR: experimental evidence on cognitive biases and debiasing interventions. *Review of Public Personnel Administration* **40**, 56–81.

- Cassell E (1993) The Sourcer's broom. Medicine's Rampant technology. *The Hastings Center Report* **23**, 32–39.
- Chatterjee K (2009) The Swan-Ganz catheters: past, present, and future. *Circulation* **119**, 147–152.
- Cooke CE, Sidel M, Belletti DA and Fuhlbrigge AL (2012) Clinical inertia in the management of chronic obstructive pulmonary disease. *COPD* **9**, 73–80.
- Coronini-Cronberg S, Bixby H, Lavery AA, Wachter RM and Millett C (2015) English National health service's savings plan may have helped reduce the use of three 'low-value' procedures. *Health Affairs* **34**, 381–389.
- Croskerry P, Singhal G and Mamede S (2013a) Cognitive debiasing 1: origins of bias and theory of debiasing. *BMJ Quality & Safety* **22**, ii65–ii72.
- Croskerry P, Singhal G and Mamede S (2013b) Cognitive debiasing 2: impediments to and strategies for change. *BMJ Quality & Safety* **22**(suppl. 2), ii65–ii72.
- Daniels, T. A. (2016). *To what extent should the public be involved in health disinvestment decision making: a mixed methods investigation into the views of health professionals in the English NHS*, University of Birmingham.
- Daniels T, Williams I, Robinson S and Spence K (2013) Tackling disinvestment in health care services. The views of resource allocators in the English NHS. *Journal of Health Organization and Management* **27**, 762–780.
- de Vries EF, Struijs JN, Heijink R, Hendriks RJ and Baan CA (2016) Are low-value care measures up to the task? A systematic review of the literature. *BMC Health Services Research* **16**, 405.
- Einvik G, Tjomsland O, Kvernebo K, Stavnes S and Ekeberg F (2002) Preoperativ forventning og klinisk effekt ved transmyokardial laserbehandling mot angina pectoris. *Tidsskr Nor Lægeforen* **122**, 2102–2104.
- Elshaug AG, Hiller JE and Moss JR (2008) Exploring policy-makers' perspectives on disinvestment from ineffective health-care practices. *International Journal of Technology Assessment in Health Care* **24**, 1–9.
- Elshaug AG, Watt AM, Mundy L and Willis CD (2012) Over 150 potentially low-value health care practices: an Australian study. *Medical Journal of Australia* **197**, 556–560.
- Elshaug AG, Rosenthal MB, Lavis JN, Brownlee S, Schmidt H, Nagpal S, Littlejohns P, Srivastava D, Tunis S and Saini V (2017) Levers for addressing medical underuse and overuse: achieving high-value health care. *Lancet* **390**, 191–202.
- Fredriksen S (2006) Tragedy, Utopia and medical progress. *Journal of Medical Ethics* **32**, 450–453.
- Gapanenko K, Lam D, Parker M, D'Silva J and Johnson T (2017) Unnecessary care in Canada. *Healthcare Quarterly* **20**, 10.
- Garner S and Littlejohns P (2011) Disinvestment from low value clinical interventions: NICEly done? *BMJ* **343**, d4519.
- Gelijns AC and Halm EA (1991) *The Diffusion of New Technology: Costs and Benefits to Health Care*. Washington, DC: National Academies Press. ISBN-10: 0-309-04491-X.
- Gigerenzer G (2015) *Calculated Risks: How to Know When Numbers Deceive you*. New York: Simon and Schuster.
- Glasiou P, Straus S, Brownlee S, Trevena L, Dans L, Guyatt G, Elshaug AG, Janett R and Saini V (2017) Evidence for underuse of effective medical services around the world. *Lancet* **390**, 169–177.
- Gliwa C and Pearson SD (2014) Evidentiary rationales for the choosing wisely top 5 lists. *JAMA* **311**, 1443–1444.
- Graber ML, Kissam S, Payne VL, Meyer AN, Sorensen A, Lenfestey N, Tant E, Henriksen K, LaBresh K and Singh H (2012) Cognitive interventions to reduce diagnostic error: a narrative review. *BMJ Quality & Safety* **21**, 535–557. doi: 10.1136/bmjqs-2011-000149
- Greenhalgh T (2013) Five biases of new technologies. *The British Journal of General Practice* **63**, 425.
- Greenhalgh T, Wherton J, Papoutsis C, Lynch J, Hughes G, A'Court C, Hinder S, Fahy N, Procter R and Shaw S (2017) Beyond adoption: a New framework for theorizing and evaluating nonadoption, abandonment, and challenges to the scale-up, spread, and sustainability of health and care technologies. *Journal of Medical Internet Research* **19**, e367.
- Haas M, Hall J, Viney R and Gallego G (2012) Breaking up is hard to do: why disinvestment in medical technology is harder than investment. *Australian Health Review* **36**, 148–152.
- Harris IA (2016) *Surgery, the Ultimate Placebo: A Surgeon Cuts Through the Evidence*. Sydney: University of New South Wales Press.
- Harris C, Allen K, Waller C and Brooke V (2017a) Sustainability in health care by allocating resources effectively (SHARE) 3: examining how resource allocation decisions are made, implemented and evaluated in a local healthcare setting. *BMC Health Services Research* **17**, 340.
- Harris C, Green S, Ramsey W, Allen K and King R (2017b) Sustainability in health care by allocating resources effectively (SHARE) 9: conceptualising disinvestment in the local healthcare setting. *BMC Health Services Research* **17**, 633.
- Henshall C, Schuller T and Mardhani-Bayne L (2012) Using health technology assessment to support optimal use of technologies in current practice: the challenge of 'disinvestment'. *International Journal of Technology Assessment in Health Care* **28**, 203–210.
- Hobson K (2009) Cost of medicine: are high-tech medical devices and treatments always worth it. US News World Rep.
- Hofmann B (1998) Black boxes and white elephants [in Norwegian]. *Tidsskrift for Helse Medisinsk Teknisk* **5**, 30–32.
- Hofmann B (2002a) Is there a technological imperative in health care? *International Journal of Technology Assessment in Health Care* **18**, 675–689.
- Hofmann B (2002b) On the ethics of medical technology [in Norwegian]. *HMT – Helsetjenesten Medisinsk Teknisk : Helse, Medisin, Teknisk* **9**, 28–31.
- Hofmann B (2002c) *The Technological Invention of Disease – on Disease, Technology and Values*. Oslo: University of Oslo.

- Hofmann B** (2006) When means become ends: technology producing values. *Seminar.net: Media, Technology and Lifelong Learning* 2. <http://www.seminar.net/current-issue/when-means-become-ends-technology-producing-values>.
- Hofmann B** (2010) Too much of a good thing is wonderful? A conceptual analysis of excessive examinations and diagnostic futility in diagnostic radiology. *Medicine, Health Care, and Philosophy* 13, 139–148.
- Hofmann B** (2019a) Progress bias versus status quo bias in the ethics of emerging science and technology. *Bioethics*: Online Early view.
- Hofmann B** (2019b) Biases and imperatives in handling medical technology. *Health Policy and Technology* 8, 377–385.
- Hofmann B** (2020) Biases distorting priority setting. *Health Policy* 124, 52–60.
- Hofmann B and Skolbekken JA** (2017) Surge in publications on early detection. *BMJ* 357, j2102.
- Hollingworth W and Chamberlain C** (2011) NICE Recommendations for disinvestment. *BMJ* 343, d5772.
- Howard L, Wessely S, Leese M, Page L, McCrone P, Husain K, Tong J and Dowson A** (2005) Are investigations anxiolytic or anxiogenic? A randomised controlled trial of neuroimaging to provide reassurance in chronic daily headache. *Journal of Neurology Neurosurgery & Psychiatry* 76, 1558–1564.
- Iacobucci G** (2018) NHS Proposes to stop funding 17 ‘unnecessary’ procedures. *BMJ* 362.
- Ibargoyen-Roteta N, Gutiérrez-Ibarluzea I and Asua J** (2010) Guiding the process of health technology disinvestment. *Health Policy* 98, 218–226.
- Johnson GL** (1982) An opportunity cost view of fixed asset theory and the overproduction trap: comment. *The American Journal of Agricultural Economics* 64, 773–775.
- Kahneman D and Tversky A** (1977) *Intuitive Prediction: Biases and Corrective Procedures*. Mclean VA: Decisions and Designs Inc .
- Kahneman D and Tversky A** (1996) On the reality of cognitive illusions. *Psychological Review* 103, 582–591.
- Kahneman D and Tversky A** (2013) *Choices, Values, and Frames, Handbook of the Fundamentals of Financial Decision Making: Part I*. Singapore: World Scientific 269–278.
- Kahneman D, Slovic P and Tversky A** (1982) *Judgement under Uncertainty: Heuristics and Biases*. New York, Cambridge: Cambridge University Press.
- Kahneman D, Knetsch JL and Thaler RH** (1991) Anomalies: the endowment effect, loss aversion, and status quo bias. *The Journal of Economic Perspectives* 5, 193–206.
- Lakoff G and Johnson M** (1999) *Philosophy in the Flesh*. New York: Basic books.
- Lee CS, Nagy PG, Weaver SJ and Newman-Toker DE** (2013) Cognitive and system factors contributing to diagnostic errors in radiology. *American Journal of Roentgenology* 201, 611–617.
- Levinson W, Kallewaard M, Bhatia RS, Wolfson D, Shortt S and Kerr EA** (2015) ‘Choosing wisely’: a growing international campaign. *BMJ Quality & Safety* 24, 167–174.
- MacKean G, Noseworthy T, Elshaug AG, Leggett L, Littlejohns P, Berezanski J and Clement F** (2013) Health technology reassessment: the art of the possible. *International Journal of Technology Assessment in Health Care* 29, 418–423.
- Malik H, Marti J, Darzi A and Mossialos E** (2018) Savings from reducing low-value general surgical interventions. *British Journal of Surgery* 105, 13–25.
- Mandell HN** (1983) Technological imperative. Or, when your tool is a hammer, everything looks like a nail. *Postgraduate Medicine* 74, 24–26.
- Mazarr MJ** (2016) *Rethinking Risk in National Security: Lessons of the Financial Crisis for Risk Management*. New York: Springer.
- McDonald KM, Matesic B, Contopoulos-Ioannidis DG, Lonhart J, Schmidt E, Pineda N and Ioannidis JP** (2013) Patient safety strategies targeted at diagnostic errors: a systematic review. *Annals of Internal Medicine* 158(5_Part_2), 381–389.
- Michie S, Johnston M, Abraham C, Lawton R, Parker D and Walker A** (2005) Making psychological theory useful for implementing evidence based practice: a consensus approach. *BMJ Quality & Safety* 14, 26–33.
- Michie S, Van Stralen MM and West R** (2011) The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Science* 6, 42.
- Newman-Toker DE and Pronovost PJ** (2009) Diagnostic errors – the next frontier for patient safety. *JAMA* 301, 1060–1062.
- Niven DJ, Mrklas KJ, Holodinsky JK, Straus SE, Hemmelgarn BR, Jeffs LP and Stelfox HT** (2015) Towards understanding the de-adoption of low-value clinical practices: a scoping review. *BMC Medicine* 13, 255.
- Noseworthy T and Clement F** (2012) Health technology reassessment: scope, methodology, & language. *International Journal of Technology Assessment in Health Care* 28, 201–202.
- Okonofua EC, Simpson KN, Jesri A, Rehman SU, Durkalski VL and Egan BM** (2006) Therapeutic inertia is an impediment to achieving the healthy people 2010 blood pressure control goals. *Hypertension* 47, 345–351.
- Parkinson B, Sermet C, Clement F, Crausaz S, Godman B and Garner S** (2015) Disinvestment and value-based purchasing strategies for pharmaceuticals: an international review. *Pharmacoeconomics* 33, 905–924.
- Pathirana T, Clark J and Moynihan R** (2017) Mapping the drivers of overdiagnosis to potential solutions. *BMJ* 358, j3879.
- Polisena J, Clifford T, Elshaug AG, Mitton C, Russell E and Skidmore B** (2013) Case studies that illustrate disinvestment and resource allocation decision-making processes in health care: a systematic review. *International Journal of Technology Assessment in Health Care* 29, 174–184.

- Prusaczyk B, Swindle T and Curran G** (2020) Defining and conceptualizing outcomes for de-implementation: key distinctions from implementation outcomes. *Implementation Science Communications* **1**, 43.
- Raffle A and Muir Gray J** (2007) *Screening: Evidence and Practice*. New York, NY: Oxford University Press.
- Rank B** (2008) Executive physicals – bad medicine on three counts. *New England Journal of Medicine* **359**, 1424–1425.
- Reach G, Pechtner V, Gentilella R, Corcos A and Ceriello A** (2017) Clinical inertia and its impact on treatment intensification in people with type 2 diabetes mellitus. *Diabetes & Metabolism* **43**, 503–511. doi: 10.1016/j.diabet.2017.06.003.
- Ruano-Raviña A, Velasco-González M, Varela Lema L, Cerdá-Mota T, Ibarгойen Roteta N and Gutiérrez Ibarluzea I** (2007) Identification, prioritisation and assessment of obsolete health technologies. A methodological guideline. HTA Reports: avalia-t Madrid, Ministry of Science & Innovation.
- Saini V, Brownlee S, Elshaug AG, Glasziou P and Heath I** (2017a) Addressing overuse and underuse around the world. *Lancet* **390**, 105–107.
- Saini V, Garcia-Armesto S, Klemperer D, Paris V, Elshaug AG, Brownlee S, Ioannidis JP and Fisher ES** (2017b) Drivers of poor medical care. *Lancet* **390**, 178–190.
- Saposnik G and Montalban X** (2018) Therapeutic inertia in the new landscape of multiple sclerosis care. *Frontiers in Neurology* **9**, 174.
- Saposnik G, Redelmeier D, Ruff CC and Tobler PN** (2016) Cognitive biases associated with medical decisions: a systematic review. *BMC Medical Informatics and Decision Making* **16**, 138.
- Saririan M and Eisenberg M** (2003) Myocardial laser revascularization for the treatment of end-stage coronary artery disease. *American Journal of Cardiology* **41**, 173–183.
- Sauro K, Bagshaw SM, Niven D, Soo A, Brundin-Mather R, Leigh JP, Cook DJ and Stelfox HT** (2019) Barriers and facilitators to adopting high value practices and de-adopting low value practices in Canadian intensive care units: a multi-method study. *BMJ Open* **9**, e024159.
- Schmidt DE** (2012) The development of a disinvestment framework to guide resource allocation decisions in health service delivery organizations. *University of British Columbia*.
- Schwartz AL, Landon BE, Elshaug AG, Cherner ME and McWilliams JM** (2014) Measuring low-value care in Medicare. *JAMA Internal Medicine* **174**, 1067–1076.
- Scotland G and Bryan S** (2017) Why do health economists promote technology adoption rather than the search for efficiency? A proposal for a change in our approach to economic evaluation in health care. *Medical Decision Making* **37**, 139–147.
- Scott IA and Duckett SJ** (2015) In search of professional consensus in defining and reducing low-value care. *Medical Journal of Australia* **203**, 179–181.
- Scott I and Elshaug A** (2013) Foregoing low-value care: how much evidence is needed to change beliefs? *Internal Medicine Journal* **43**, 107–109.
- Selby K, Gaspoz J-M, Rodondi N, Neuner-Jehle S, Perrier A, Zeller A and Cornuz J** (2015) Creating a list of low-value health care activities in Swiss primary care. *JAMA Internal Medicine* **175**, 640–642.
- Shain M and Roemer MI** (1959) Hospital costs relate to the supply of beds. *Journal of Occupational and Environmental Medicine* **1**, 518.
- Slovic P** (2016) *The Perception of Risk*. London: Routledge.
- Slovic P and Peters E** (2006) Risk perception and affect. *Current Directions in Psychological Science* **15**, 322–325.
- Solomons NM and Spross JA** (2011) Evidence-based practice barriers and facilitators from a continuous quality improvement perspective: an integrative review. *Journal of Nursing Management* **19**, 109–120.
- Soril LJ, MacKean G, Noseworthy TW, Leggett LE and Clement FM** (2017) Achieving optimal technology use: a proposed model for health technology reassessment. *Sage Open Medicine* **5**, 2050312117704861.
- Soril LJJ, Seixas BV, Mitton C, Bryan S and Clement FM** (2018) Moving low value care lists into action: prioritizing candidate health technologies for reassessment using administrative data. *BMC Health Services Research* **18**, 640.
- Strand R, Saltelli A, Giampietro M, Rommetveit K and Funtowicz S** (2016) New narratives for innovation. *Journal of Cleaner Production* **197**, 1849–1853.
- Tinghög G and Västfjäll D** (2018) Why People Hate Health Economics – Two Psychological Explanations, Linköping University, Division of Economics, Department of Management and Engineering.
- Tymstra T** (1989) The imperative character of medical technology and the meaning of ‘anticipated decision regret’. *International Journal of Technology Assessment in Health Care* **5**, 207–213.
- van Bodegom-Vos L, Davidoff F and Marang-van de Mheen PJ** (2017) Implementation and de-implementation: two sides of the same coin? *BMJ Quality & Safety* **26**, 495–501.
- Welch HG and Black WC** (2010) Overdiagnosis in cancer. *Journal of the National Cancer Institute* **102**, 605–613.
- Welch HG, Schwartz L and Woloshin S** (2011) *Overdiagnosed: Making People Sick in the Pursuit of Health*. Boston, Mass.: Beacon Press.
- Willson A** (2015) The problem with eliminating ‘low-value care’. *BMJ Quality & Safety* **24**, 611–614.
- Wilmshurst P** (2011) The regulation of medical devices. Unsatisfactory, unscientific, and in need of a major overhaul. *BMJ* **342**, d2822.

- Wilson TD and Brekke N** (1994) Mental contamination and mental correction: unwanted influences on judgments and evaluations. *Psychological Bulletin* **116**, 117.
- Wolf S and Berle B** (1981) *The Technological Imperative in Medicine*. New York: Plenum Press.
- Wright B and Bragge P** (2017) What strategies to review diagnoses are feasible and sustainable in Emergency Departments?. Melbourne, Australia: Behaviour Works Australia, Monash University. ISSN: 2208-6080.

Cite this article: Hofmann B (2021). Internal barriers to efficiency: why disinvestments are so difficult. Identifying and addressing internal barriers to disinvestment of health technologies. *Health Economics, Policy and Law* **16**, 473–488. <https://doi.org/10.1017/S1744133121000037>