

Stratified users and technologies of empowerment: theorising social inequalities in the use and perception of diabetes self-management technologies

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Abstract Medical technologies of various kinds play an increasingly important role in medical treatment, but may also increase health inequalities if they are primarily used by high-status patients. While many have problematised inequalities in the material access to medical technologies, differences in use and perception are also salient for explaining the relationship between medical technologies and health inequalities. This article attempts to theorise these inequalities by bringing health inequality research into dialogue with social constructivist perspectives on user-technology relations. Based on qualitative interview data from a case study of the technological self-management of type 1 diabetes, I construct three clusters of technological practices and perceptions corresponding to three broad user types. These user types are then discussed in the context of patient empowerment and the promotion of the active, autonomous and self-reflective ‘expert’ patient in European health care systems. To the extent that they materialise and enforce institutional expectations which only the most resourceful patients will be able to live up to, medical technologies may serve to entrench and legitimate social inequalities in health and medical care. Research therefore needs not only to consider how medical technologies are distributed, but also their design and appropriation by users.

Keywords: medical technology, health inequalities, social constructivism, diabetes

Introduction

Medical technologies of various kinds play an increasingly important role in disease self-management, and may reduce the risk, uncertainty and distress associated with living with a chronic condition (Lupton 2012: 46). Critical accounts have suggested that technological innovation may serve to increase health inequalities, as high-status patients may be better equipped than others to take advantage of new treatment options (Link and Phelan 1995, Shim 2010). While the hypothesis that technological innovation increases health inequalities has some empirical support, the causal mechanisms behind this relationship are still largely unknown (Weiss *et al.* 2018). This highlights the need for research capable of identifying the concrete processes through which medical technologies influence the social production of health inequalities, as well as for theoretically oriented health inequality research more generally (Scambler 2012, Veenstra 2018).

While health inequality researchers typically problematise inequalities in the distribution of and access to medical technologies, inequalities in use and perception are arguably of equal importance for explaining how and why some technologies benefit certain users more than others. The present study draws on social constructivist perspectives on user-technology relations in order to theorise these inequalities based on a case study of the technological self-management of type 1 diabetes. Specifically, the concepts of delegation (Latour 1992), prescription (Akrich 1992, Akrich and Latour 1992) and affordances (Gibson 1979, Hutchby 2001) are deployed in order to construct three clusters of technological practices and perceptions corresponding to three broad user types. The results are then discussed in the context of patient empowerment and the re-structuring of the patient role towards emphasising self-management, consumer choice and active engagement (Sinding *et al.* 2012, Vassilev *et al.* 2017). Patient empowerment has frequently been criticised for promoting an individualist conception of an educated and informed patient, which ignores the importance of unevenly distributed resources, dispositions and motivations (Hinder and Greenhalgh 2012, Strachan *et al.* 2014). Failure to live up to the role of an empowered patient may impact treatment decisions and self-esteem, exacerbating social inequalities in health and access to medical care (Savage *et al.* 2013, Sinding *et al.* 2012). In so far as stratifying norms are materialised in the design, implementation and use of self-management technologies, technological development may therefore contribute to re-producing existing inequalities in treatment and outcome. The article contributes to the existing literature by conceptualising inequalities in the use and perception of medical technologies, by considering the ambivalent role played by medical technologies in the turns towards patient empowerment, and by bringing health inequality research into dialogue with social constructivist perspectives.

Theorising the design, usage and perception of medical technologies

Depending on their design, medical technologies may either construct, reinforce or challenge dominant medical norms and power relations (Fox *et al.* 2005). Historically, medical sociologists have often studied medical technologies in the context of medicalisation, a process where medicine extends its control over society by re-defining various conditions as medical problems (Timmermans and Berg 2003). Hence, medical technologies have often been treated as direct sources of medical power, or as static, ahistorical and inert objects infused with a dynamic power to re-shape social practices and interactions (Casper and Morrison 2010, Conrad 1979). This also holds true for the largely quantitative research examining the relationship between technological innovation and health inequalities, which has paid little attention to how people use and perceive medical technologies in their daily lives (Weiss *et al.* 2018).

During the last decades, social constructivist perspectives have challenged essentialist notions by highlighting the complex relationships between technological artefacts and the people who use them (Casper and Morrison 2010, Lupton 2012: 16–9). Social constructivist accounts typically begin from the premise that technological design is a social process which seeks to fulfil socially and culturally defined needs. By inviting specific patterns of thought and behaviour and foreclosing others, technological artefacts embody social norms and cultural values which may be studied through interpretive methods (Feenberg 1999, Vallor 2016). One of the ways in which norms are embodied in technologies is through *delegation*, a process in which a social obligation (closing a door in Latour's classic example) is delegated onto a technical device (e.g. a door hinge which closes the door automatically). Technologies also impose behaviour back on human actors through processes of *prescription* (Latour 1992: 175). Prescription refers to the set of actions that any given device enables or forecloses, in a way

which establishes certain expectations towards which actors subscribe by altering their behaviour in various ways. It is important to stress that technology does not determine this behaviour, and that actors may subscribe in a number of different ways. Actors may choose to conform to the expectations prescribed to them, attempt to underwrite the technology by acting in subversive ways, extract themselves from the situation or simply fail to use the technology in the intended manner (Akrich and Latour 1992: 261).

Social constructivist research has generally highlighted the non-essential and non-deterministic nature of technologies by focusing on how users appropriate, modify, reconfigure, resist and reject technologies in various ways (Hutchby 2001). However, the co-construction of users and technologies is constrained by social and cultural factors, which includes disparities in power and resources between different groups of actors (Oudshoorn and Pinch 2003). The concept of *affordance* has been proposed as a way to account for the constraining and enabling features of technological objects, focusing specifically on their material properties (Hutchby 2001). Originally formulated by Gibson (1979: 127) in the psychology of perception, the concept points to how humans and other animals orient towards objects in the world based on their possibilities for action. Affordances exist relative to the attitudes and behaviour of the one who is perceiving them, meaning that the act of perception of a given object also involves a co-perception of one's own dispositions and abilities (ibid. 141). The concept therefore highlights that the perception and use of technological artefacts is neither fully determined nor entirely contingent, and that the possibilities a given technology affords is a function of the complementarity between the object's material properties and the properties, behaviours and dispositions of its user (Hutchby 2001).

Summing up the argument thus far, the dual processes of delegation and prescription creates a division of labour between medical technologies and their users which reflect broader norms about patienthood, health and illness. A working assumption in the following analysis will be that these norms, and by extension technological design, are embedded in and shaped by social hierarchies of class, power and stratification, and that this provides a key insight for explaining inequalities in technological self-management practices and perceptions. Medical technologies have both enabling and constraining features, which are perceived as affordances relative to behaviour and dispositions of the person observing them. In so far as medical technologies provide affordances which enable and constrain patients according to their social, cultural and economic resources, they may therefore serve to justify reproduce and justify social inequalities in health. The research question guiding the empirical investigation will therefore be how users use and perceive medical technologies, and how these practices and perceptions are oriented towards the norms and values these technologies prescribe. Finally, I will discuss how the design, use and perceptions of medical technologies may be said to reflect or enforce existing social inequalities in medical care.

Case and methods

Type 1 diabetes is a condition where the pancreas is unable to produce insulin for the body, requiring the patient to administer industrially manufactured insulin on a daily basis in order to survive. Self-management of type 1 diabetes is highly demanding, and comprises a variety of practical, cognitive and emotional tasks (Lutfey and Freese 2005). Previous research has identified significant socioeconomic inequalities in outcomes, self-management practices, perceptions, technology provision and quality of care (Al Sayah *et al.* 2013, Franklin 2016, Naranjo *et al.* 2016, Sortso *et al.* 2018). Qualitative studies have often constructed typologies of diabetes patients by distinguishing between 'active' (often characterised as knowledgeable,

self-confident and resourceful) and 'non-active' (often characterised as lacking resources and emotionally driven) patients (Campbell *et al.* 2003, Weaver *et al.* 2014). Ethnographic and narrative accounts have revealed that diabetes self-management is enabled and constrained by a variety of factors, ranging from individual dispositions and capabilities through macro-level factors such as economic conditions, cultural norms and the health care organisation (Greenhalgh *et al.* 2011, Hinder and Greenhalgh 2012, Lutfey and Freese 2005). As with many other chronic conditions, type 1 diabetes therefore challenges the 'logic of choice' underpinning empowerment discourses, and its tendency to ignore the social and emotional dimensions of health care (Mol 2008, Vassilev *et al.* 2017).

As nearly all people with type 1 diabetes depend on some sort of user-administered technology for providing insulin and monitoring glucose levels, the phenomenological experience and the practical management of diabetes is profoundly technologically textured (Mol 2008). Adapting to new technologies (e.g. by switching from insulin injection by needle to using an insulin pump) requires the user to learn new skills and competencies through active experimentation and self-reflection (Reidy *et al.* 2018). The challenging, stratified and technological nature of diabetes care makes it an excellent case for studying the relationship between technological development, self-management and health inequalities. In particular, the analysis focuses on digital insulin pumps and continuous glucose monitoring (CGM) systems, which will be described in more detail below. While insulin pumps and CGMs produced by different manufacturers will have some unique features depending on their manufacturer and model, I have followed the existing literature by treating them as generic technology types for analytic purposes (Lawton *et al.* 2018, Reidy *et al.* 2018).

The present article draws on qualitative data from in-depth interviews with patients with diabetes type 1 ($n = 24$) conducted in Norway during the autumn and winter of 2018. In order to allow for comparisons between patient groups, informants of varying socioeconomic backgrounds, genders, ages and sickness histories were interviewed. The final sample consisted of informants between the ages of 18 and 72, ranged from freshly diagnosed patients to those who had been living with type 1 diabetes for decades, and included people who were students, nurses, teachers, researchers, technicians, unemployed and disabled. While the final sample was slightly skewed towards females and informants with higher education, the data was heterogeneous enough to provide information about significant variations in self-management practices, perceptions and sickness histories (see Table A1 in the Appendix for complete sample details). Each interview lasted between 40 and 70 minutes each, with an average duration of approximately 50 minutes. Informants were asked about their daily routines for managing their diabetes, how medical technologies entered into these self-management practices, interactions with nurses and other medical staff, as well as their general experience of living with type 1 diabetes. In order to pinpoint the role played by technologies specifically, I also asked about their self-management practices and illness experiences had evolved over time, focusing on transitions between different technological set-ups. For context, I also interviewed five diabetes physicians and three nurses about how their use and provision of medical technologies in diabetes treatment. All interviews were transcribed verbatim and analysed abductively with the aim of conceptual generalisation (Timmermans and Tavory 2012, Tjora 2019). Quotes were translated into English by the author, with some minor adjustments for aesthetic purposes. As the data provided by the interviews are too small and heterogeneous to be empirically generalisable, specific cases have been selected for theoretical rather than illustrative purposes. The analysis is therefore not intended to summarise the empirical variation in the data or to make substantial claims about the use of diabetes technology in Norway or elsewhere, but to construct theoretical categories which may be useful for interpretive purposes or for operationalisation in quantitative or qualitative research.

Analysis: technological practices, perceptions and social characteristics

The present analysis is focused on two main types of medical technologies currently used in the treatment of type 1 diabetes, and which most of the informants interviewed from the study had either tested or used for an extended period at some point during their illness careers. *CGM systems* work by automatically taking glucose measurements at regular intervals, providing detailed statistical information about glucose levels and fluctuations over time. *Insulin pumps* are devices which deliver insulin continuously through a catheter placed under the skin, and are designed to work as flexible and convenient alternatives to standard methods of insulin administration by injection. Insulin pumps are often used in conjunction with CGMs and methods for carbohydrate calculation, and allows the user to input his or her own insulin 'programs.' Both technologies are designed and marketed as tools to increase the individual user's control by providing statistical information and a range of treatment options and semi-automated functions. While successful uptake of insulin pump and CGM technologies requires the user to reflexively re-interpret their bodily sensations and adopt new treatment behaviours (Mathieu-Fritz and Guillot 2017), the devices are also complex enough to allow for variations in appropriation and interpretation between users. This makes CGMs and insulin pumps a good case for examining how technological prescriptions may translate into inequalities in use, perceptions and outcome between patient groups.

In order to analyse social variations in the use and perceptions of these technologies, I will outline three clusters of technological practices and perceptions corresponding to three broad user types. Examining differences between users provides an opportunity to analyse the social and cultural constraints which structure user-technology relations (Oudshoorn and Pinch 2003). The analysis also includes the experiences of non-users, who have been highlighted as a particularly useful group for challenging technological norms and expectations (Wyatt 2003). It is important to note that the descriptions of the various user types are not meant to summarise the empirical variation in the sample, but are constructed as ideal types by selectively emphasising some attributes and similarities over others for analytic purposes (Weber 2012). While the selected cases do reflect some general patterns and experiences in the data, they should not be read as illustrative of the empirical variation in any given sample or population. The three user types described below are analytical categories, and are not meant to suggest that people empirically may be easily sorted into mutually exclusive categories. Rather, the data suggests that people may inhabit two or all three user types at various points during their illness careers, but that patterns will emerge over time where some may be said to predominantly belong to a specific type rather than others.

The active user

The first user type I want to examine may be defined as the *active user*. Active users typically emphasised the importance of information and control, and used medical technologies in order to micro-manage their condition with the purpose of maximising outcomes and wellbeing. A typical example of an active user was Mark, a 38-year-old scientist who used an insulin pump and a glucose monitoring system (CGM). Mark frequently highlighted the pedagogic value of the CGM, which allowed him to closely monitor the effect of how different foods affected his glucose levels:

I feel that I learn a lot by looking at the CGM. How different meals affect me in different ways, things I wouldn't consider before I started using it. Some things are surprising. For example, a cold potato, or a potato that has been re-heated, has almost no impact on glucose levels compared to a regular boiled potato. You can experiment and see the effect of

different food items [...] You can see how the effect of food changes depending on the order you eat it. If you start by eating the salad, and save the food containing glucose for last, the effect is huge. (Mark)

Over the years, Mark had built up a repertoire of 'tricks' for managing his diabetes, some of which he had read about online, and others which he had come up with himself through experimentation: «I may split my breakfast in two if I feel it makes my glucose levels easier to control [...] If you take a small break and save the rest of the meal for later, you can reduce the problem considerably». As this quote suggests, the affordances provided by the CGM allowed Mark to take a self-reflective and experimental approach towards his condition, using statistics and visual indicators in order to evaluate the effect of different practices and routines.

Another informant who may be described as an active user was Craig, a 30-year old male IT technician. While most of the other informants interviewed for this study used technological devices provided by the Norwegian health care system, Craig had created his own setup by connecting a state-provided insulin pump, a commercially available glucose monitoring systems and a radio transmitter. As a part of his daily routine, Craig also used apps for automating insulin dosage, tracking his food consumption and monitoring his blood sugar levels.

Over the years, Craig had developed an interest in diabetes technology, and would regularly read about the subject online: «I'm interested in the technological discussions about diabetes. Not in the social aspects [...] I don't read discussions where people write 'I feel bad, what do I do?'. That doesn't interest me too much.» In this quote, Craig draws a distinction between the technical and the medical aspect of his diabetes, viewing the former as a source of prestige distinguishing him from other patients. During our interview, Craig frequently highlighted the exclusive nature of his set-up: «I would guess that there is probably 1000–1500 people who use this worldwide. There's not a lot of us. You need a bit of knowledge, and you have to assemble it by yourself». One way of interpreting Craig's experience is that his skills as an IT worker enabled him to meet and even surpass the expectations prescribed by 'standard' diabetes technologies, which in turn opened up a range of affordances which distinguished him from other and less proficient patients. Rather than being passive subjects of biomedical subjectivation or technological dominance, active users often expressed feelings of power vis-a-vis their technologies. A possible explanation for this may be that medical technologies tend to reward technological proficiency, literacy and purposiveness, characteristics which are commonly associated with social advantage (Dubbin *et al.* 2013, Shim 2010). Indeed, Craig and Mark were both male, middle-class and highly educated, and therefore possessed several traits which would seem to enable them to live up to the ideal of an engaged and technically competent user. For active users, therefore, insulin pumps and CGM systems functioned as a means to assert and extend their already significant control over their diabetes self-management, as well as a symbolic resource distinguishing them from other patients.

The passive user

While passive users used the same technologies as the active users described above, both their use and perceptions of these technologies varied considerably. Rather than using technologies as a source of increased control, passive users generally preferred delegating as many disease-related tasks onto the technological devices as possible. They often described self-managing their diabetes as uncomfortable, difficult and tiresome, and utilised technologies in order to make their daily lives easier and less distressing. Passive users would therefore often describe themselves as 'dependent' on the technology: «I'm the kind of person who depends on the CGM [...] I'm really bad at remembering to inject insulin before I eat, so often it won't

happen before it tells me that my blood sugar levels are rising (Brix).» Their dependency became especially clear in situations when the technological equipment stopped working:

I couldn't manage without the pump [. . .] This Easter, my pump broke and I had to go back to using a pen because the hospital couldn't mail me a new one in time before the vacation. That was horrible. The pump didn't work, the CGM didn't work, nothing [. . .] My blood sugar levels were really high during the entire Easter break. I felt like I spent the whole break poking myself with the insulin pen. I really missed having my pump. (Kay)

A 32-year-old woman who had recently re-entered the educational system in order to build on her basic education, Kay primarily used features for which automated insulin delivery and sounded off alarms when her glucose levels went too high or too low. In this she differed from the active users described above, who used technologies for experimentation and micro-management. Passive users would sometimes admit to using the devices in other ways than they thought was intended:

The advantage of using an Omnipod is that I can type in my glucose levels and how many carbohydrates there are in the food I will be eating, and there is a calculator that will automatically tell me how much insulin I need. But it's so easy to just skip counting the carbohydrates and guess the dose myself. (Stephen)

Stephen admits to avoiding his insulin pump's most advanced features, preferring instead to use a less accurate method based on his own intuition and past experience. Later in the interview, he stated that the device did have an initial effect on his self-management practices, but that this gradually wore off: «I had a small notebook where I wrote down everything I ate. Nicely presented statistics. Now I just do what I want [. . .] It was fun in the beginning, but like with any other thing you grow tired with time». That Stephen returned to his earlier routine after an initial period of enthusiasm should be interpreted as an argument against determinist notions that medical technologies simply force biomedical practices and self-perceptions on those who use them. Rather, the meanings of medical technologies are constituted in the interplay between the opportunities afforded by the devices and how these are appropriated by users during their daily lives. Furthermore, how informants perceived and used the diabetes technologies often seemed to reflect their general orientation towards the disease itself:

I tend to postpone changing the needles on my CGM device. That's kind of the attitude I have towards injecting insulin or measuring blood sugar in general, towards diabetes as a whole, really. It has to be as little work as possible. (Brix)

Kay, Brix and Stephen generally preferred to think as little about their diabetes as possible, and all expressed desires for fully automated systems which would remove the necessity of managing their diabetes entirely. For passive users, CGMs and pumps became a tool for minimising their diabetes' presence in their life-world, which could translate into ambivalent perceptions of the technological objects themselves. On the one hand, many perceived technologies as a limited and valuable resource, and would speak of themselves as 'lucky' or 'fortunate' to have received insulin pumps or CGM systems through the Norwegian public health service. As material objects, however, the technologies were often perceived as stigmatising reminders of their own condition, and many preferred the devices to be as non-intrusive as possible. However, passive users were still able to and willing to meet the basic expectations the technologies prescribed, enabling a division of labour where disease-related tasks were largely delegated onto technological devices.

The antagonistic user

The third patient type I want to describe are *antagonistic users*, a group whose practices and perceptions were characterised by conflicts, ruptures and breakdowns in the human-technology relation. Antagonistic users would often (intentionally or unintentionally) misuse, sabotage or harm their technologies, for example, by ignoring alarms, neglecting to replace vital user equipment or even throwing them at the wall in fits of frustration. Often, they would end up rejecting the devices entirely in favour of older and less technologically advanced set-ups. A typical example was Julia, a 58-year-old woman who at the time of interview was living through her thirteenth year with type 1 diabetes.

I've tried insulin pumps and other stuff, but that didn't work for me. Now I'm back to using regular syringes and measuring strips [. . .] First and foremost, my blood sugar didn't really improve. The second thing was that it squealed constantly. That thing squealed when my glucose levels were high, when they were low, when I was supposed to measure, and when I was supposed to do extra measurements as well . . . It almost drove me crazy. I couldn't live like that. (Julia)

Julia's experience is illustrative for how antagonistic users often perceived medical technologies as strange, frightening and stigmatising. Antagonistic users generally experienced managing their diabetes as arduous and distressing, and therefore wished to minimise the presence of the diabetes in their daily lives as much as possible. In this they shared a common goal with the passive users described above, with the important difference that they for various reasons failed or refused to integrate the technologies into their self-management practices. This is illustrated by the following excerpt from my interview with Marcia, a 29-year-old woman who was currently on sick leave from her job as a retail worker:

[The CGM] was beeping constantly.
Was that your main problem, the noise?

Yes, and the fact that I was supposed to recalibrate it twice daily. I had to perform a blood sugar measurement to prevent it from beeping.

How good were you at recalibrating?
Not too good, honestly.

In this case, Marcia's failure or refusal to comply with the CGMs prescription of recalibrating her device led it to becoming more intrusive, which ultimately made her stop using the device altogether. Furthermore, antagonistic users would often describe the physical properties of medical technologies as heavy, cumbersome, painful or other negative characteristics. Such descriptions were particularly common for female informants, potentially suggesting a gendered dynamic where women perceive technological devices as more bodily intrusive than men. Rather than viewing technologies as a source of prestige vis-a-vis other patient groups, antagonistic users often perceived them as unpleasant reminders of their own powerlessness, primarily perceiving the technological affordances as constraining and debilitating. Here is Julia again, describing her experiences with an app for calculating carbohydrates and insulin dosage:

Before every meal you are supposed to sit down and calculate carbohydrates . . . I can't live like that. It's just too much work for me [. . .] If you are going to eat something, and then you have to type for 5 minutes every time you . . . It's too tiresome. You have other things to do as well. It's okay for a short while, but I can't live like that [. . .] It's no good. It's just too much work. It's too complicated. It really makes you think that you are sick as well. (Julia)

In this quote, Julia expresses a fairly common theme among antagonistic users, namely their perception that medical technologies made them feel sicker than they would otherwise. Another notable feature of Julia's talk is the frequent occurrences of conversation breaks and repetition, indicating feelings of powerlessness and frustration. This combination of medicalisation and powerlessness might be of central importance for explaining the logic of antagonistic human-technology relations. While active and passive users also perceived the technologies as reminders of their diabetes, they would often describe this as a positive feature, as the technology would either reassure them that they were okay or make them conscious of the steps they needed to take in order to get better. This suggests that people's perceptions of the enabling and constraining features of medical technologies will shape and be shaped by their perception of their own ability to self-manage their illness, which may in turn depend on access to material, social and cultural resources. As an ageing, disabled woman with low education, most measures of social position utilised in health inequality research would locate Julia at the opposite end from the male and highly educated active users discussed previously. The same technologies which active users perceived as a source of control and autonomy for Julia became a source of shame and frustration, suggesting the presence of a stratifying logic shaping the relationship between medical technologies and the people who use them.

Theoretical discussion

In her book on the quantified self, Lupton (2016: 140) criticises medical self-tracking technologies such as CGMs for assuming a resourceful user located within a supportive economic and social environment. Extending Lupton's analysis, Mathieu-Fritz and Guillot (2017: aj) argue that diabetes patients are a heterogeneous and stratified group: 'While some are deeply involved in the management of their diabetes and their use of CGM devices, others have no wish to use them or cannot afford to acquire and use them continuously, with the result that gaps have opened up between categories of patients.' The present analysis deepens and extends this argument by theorising inequalities in the use and perception of medical technologies based on a case study of insulin pumps and CGM systems. The *active user* uses medical technologies in order to micro-manage their condition by hermeneutically interpreting and manipulating biometric data. By contrast, the *passive user* relies on delegating sickness work onto technological devices, establishes a division of labour where the technology functions to minimise the presence of their disease in their life-worlds. Finally, the *antagonistic user* perceives medical technologies as constraining sources of shame and powerlessness, in part because their failure or refusal to comply with technological prescriptions.

Sociological studies on clinical interactions, medical resource distribution and staff's evaluation of patients have frequently highlighted that medical staff and the institutional organisation of health care services 'reward' patients who exhibit attitudes, skills and behaviours associated with a high social status (Dubbin *et al.* 2013, Potter *et al.* 2018, Sointu 2017). In so far as they materialise the same cultural values and institutional expectations that mark the health care system in general, medical technologies may also be said to 'reward' and 'punish' patients according to a similar logic. As I've argued, the affordances of medical technologies are conditioned on the degree of complementarity between the technology and the user, which in turn depends on the user being able to meet the expectations which the technology prescribe. These expectations may be interpreted through the lens of patient empowerment, which centres on the ideal of an autonomous, responsible and self-reflexive patient capable of taking control over her condition through the application of biomedical knowledge and technological self-management strategies. While the turn towards empowerment is often framed as an

antidote to medical power and paternalism, it is also motivated more cynically by an ambition to reducing increasing health care spending by shifting disease-related tasks over to the individual patient (Ong *et al.* 2014). As such, patient empowerment may be interpreted as part of a longer tradition under capitalism where rational self-management of the body is placed at the centre of ethical frameworks, often for economic and/or administrative purposes (Federici 2004: 148–55). Situating patient empowerment in this context may help highlight how empowered patients are not only given responsibility for their own private health and wellbeing, but are also expected to help realising system objectives of increased efficiency and reduced expenditures (Sinding *et al.* 2012). Medical technologies play an important, yet ambivalent role in this process, which should be explored in further research. In particular the interrelationships between the material, practical, normative and affective dimensions of medical technologies deserve further elaboration, as well as how they may serve to reflect, enforce or mitigate existing social hierarchies of power and domination.

As Klinenberg (2015: 139) points out, the flipside of a system which promotes individual responsibility in the name of efficiency may be the exclusion and shaming of those who for various reasons fail or refuse to assume these responsibilities. Indeed, UK researchers have noted how health inequalities may be exacerbated by the rise in neoliberal discourses of shaming and demonisation of dependence under neoliberalism (Bissell *et al.* 2016, Peacock *et al.* 2014). While the Norwegian health care system differs from the UK health services in significant ways, shame was indeed a common emotion among antagonistic users, as were feelings of powerlessness. As Bourdieu (2000: 221) comments, the ambition to control the future ‘varies with the real power to control that future, which means first of all having a grasp on the present itself.’ Social marginalisation and lack may produce feelings of fatalism, inclining people in adverse circumstances to believe they can do little to control their health and wellbeing (Savage *et al.* 2013). The present analysis strongly suggests that these affects will also shape and be shaped by how we use and perceive medical technologies, and that technological design may also create, enforce or mitigate health-related affects of various kinds. As such, the feelings of shame and powerlessness reported by antagonistic users towards medical technologies may be interpreted more broadly as reflecting the self-perceived failure to live up to the expectations of a public health system increasingly geared towards individual responsibility. Here, the concept of affordance proves particularly useful for explaining how the perception of technological possibilities is shaped by the observer’s co-perception of her or his own ability to effectively use them.

Traditionally, health inequality research has often limited the question of social stratification to one of socioeconomic inequality, paying less attention to other forms of privilege and disadvantage (Gkiouleka *et al.* 2018). Rather than seeing social stratification as a linear scale determined by a single factor, the analysis presented in this article invites a multi-dimensional and intersectional approach to social stratification. In particular, the possible gendered dynamic where women perceive medical technologies as more intrusive and stigmatising than men, and how this may intersect with educational and economic inequalities, deserves further examination. It is important to note that the present analysis does not provide the basis for making substantial claims about existing inequalities in technological use, and that it is always an empirical question whether variations in technological practices and perceptions map onto other social hierarchies and inequalities. The meaning of medical technologies do not exist *a priori*, but are shaped by emergent and non-predictable human practices (Piras and Miele 2017). However, these practices are fundamentally embedded in a political economy of self-management, shaped among other things by cultural expectations and the social organisation of the health care system (Hinder and Greenhalgh 2012). While many have argued that sociological theory should be integrated into health inequality research (see Scambler 2012,

Veenstra 2018, Williams 2003), an increased attention towards social inequality may therefore also benefit social constructivist research on medical technologies. Technological features that are enabling for some may be constraining for others, reflecting inequalities in technological proficiency, motivation and resources of various kinds. Paying attention to the co-construction of users and technologies may help avoid replacing a crude technological determinism with a one-sided 'romantic voluntarism' celebrating the free agency of creative users (Oudshoorn *et al.* 2004), by considering how medical technologies disproportionately enable, discipline, constrain and exclude different social groups.

In *The Politics of Life Itself*, Rose (2009: 70) characterises the tension between the ethical imperative to manage one's own health and social inequalities in the economic, technological and biomedical means to do so as a constituent feature of modern biopolitics. Similarly, Farmer (2003: 164) describes inequalities in access and outcome as 'the chief drama of modern medicine,' and argues that these inequalities are caused in part by the differential access to increasingly effective technologies. While Rose and Farmer problematise inequalities in the material access to technologies, inequalities in technological practices and perceptions are also salient for explaining the relationship between technological innovation and health inequalities. In this article, I have attempted to theorise these inequalities by considering the relationship between users and the normative dimensions of technological artefacts. To the extent that they materialise and prescribe institutional expectations which only the most resourceful patients will be able to live up to, medical technologies may serve to entrench and legitimate social inequalities in health and medical care. All this suggests that both health inequality researchers and policymakers seeking to reduce social inequalities in medical care not only need to consider how medical technologies are distributed, but also how their design, development and appropriation may serve to create and enforce patterns of inequality and stratification.

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Appendix

Table A1 Sample details

Name	Gender	Age	Occupation	Educational level	Time since diagnosis	Used CGM/insulin pump
Una	Female	23	Student	Secondary ed.	1 month	No/no
Yvonne	Female	24	Student	Secondary ed.	10 years	No/yes
Laura	Female	29	Retail clerk	Secondary ed.	22 years	Yes/yes
Brix	Female	29	Municipal administrator	Higher ed.	26 years	Yes/yes
Marcia	Female	29	Unemployed	Basic ed.	22 years	Yes/yes
Karen	Female	30	Nurse	Higher ed.	9 years	No/no
Kay	Female	32	Student	Basic ed.	30 years	Yes/yes
Lucy	Female	33	Manager of sales	Higher ed.	5½ years	Yes/yes
Elena	Female	38	Attorney	Higher ed.	14 years	No/no
Charlotte	Female	39	Teacher	Higher ed.	10 years	Yes/no
Kate	Female	44	Accountant	Higher ed.	14 years	No/yes
Ruth	Female	45	PhD candidate	Higher ed.	39 years	Yes/no
Victoria	Female	51	Hospital engineer	Higher ed.	38 years	Yes/no
Julia	Female	58	Disabled	Secondary ed.	13 years	No/no
Hilary	Female	64	Retired (former teacher)	Higher ed.	60 years	No/no
Janet	Female	72	Retired (former teacher)	Higher ed.	10 years	No/no
Stephen	Male	19	IT worker	Secondary ed.	3 years	Yes/yes
Karl	Male	24	Student	Secondary ed.	6 years	No/no
Craig	Male	30	IT worker	Higher ed.	10 years	Yes/yes
Mark	Male	38	Scientist	PhD	26 years	Yes/yes
Paul	Male	38	IT technician	Higher ed.	3 months	No/no
Simon	Male	49	Bank employee	Higher ed.	[missing]	Yes/yes
Martin	Male	59	Custodian	[missing]	20 years	Yes/no
Pete	Male	68	Retired (former bank employee)	Higher ed.	38 years	Yes/no

CGM, continuous glucose monitoring.