Digital Society (2023) 2:39
https://doi.org/10.1007/s44206-023-00071-1

ORIGINAL PAPER

Commercial mHealth Apps and the Providers' Responsibility for Hope

Leon Rossmaier[1] · **Yashar Saghai**[1] · **Philip Brey**[1]

Received: 28 February 2023 / Accepted: 18 September 2023

Abstract
In this paper, we ask whether the providers of commercial mHealth apps for self-tracking create inflated or false hopes for vulnerable user groups and whether they should be held responsible for this. This question is relevant because hopes created by the providers determine the modalities of the apps' use. Due to the created hopes, users who may be vulnerable to certain design features of the app can experience bad outcomes in various dimensions of their well-being. This adds to structural injustices sustaining or exacerbating the vulnerable position of such user groups. We define structural injustices as systemic disadvantages for certain social groups that may be sustained or exacerbated by unfair power relations. Inflated hopes can also exclude digitally disadvantaged users. Thus, the hopes created by the providers of commercial mHealth apps for self-tracking press the question of whether the deployment and use of mHealth apps meet the requirements for qualifying as a just public health endeavor.

Keywords Hope · Structural injustice · mHealth apps

1 Introduction

Commercial mobile health (mHealth) apps outside traditional healthcare contexts have become increasingly popular and raise certain hopes for their users.[1] Apps like the *Fitbit* app allow users to self-monitor multiple health-related parameters,

---

[1] We use the term "hope" rather than "expectation" because we focus on wishes of users about future benefits that they are led to believe are reasonable but that need not be accompanied by a strong belief that these benefits must materialize.

✉ Leon Rossmaier
l.w.s.rossmaier@utwente.nl

Yashar Saghai
y.saghai@utwente.nl

Philip Brey
p.a.e.brey@utwente.nl

[1] Section of Philosophy (BMS), University of Twente, Drienerlolaan 5, 7522 NB Enschede, The Netherlands

such as sleeping patterns, burnt calories, and exercise achievements. The intention is clear: users desiring to live healthier or to avoid health risks download the apps to facilitate healthy behavior changes and to become more knowledgeable about their health status. Providers of mHealth apps, such as private companies who develop, design, and sell mHealth products, promise these effects to their potential customers. Through marketing campaigns and published information online, providers of mHealth apps create hopes of empowerment, independence, increased health, and health knowledge. Public health actors and many health systems encourage the use of mHealth apps to achieve public health goals and to prevent health risks. Health authorities increasingly view mHealth apps as an important part of public health strategies (European Commission, 2014; World Health Organization, 2011, 2021).

In this paper, we ask whether the providers of commercial mHealth apps for self-tracking create inflated or false hopes for vulnerable or disadvantaged user groups regarding the prospects of health improvement or the level of protection of their personal data and whether they should be held responsible for this. This question is relevant because hopes created by the providers determine the modalities of the apps' use and the motivation for purchasing the app. For instance, due to the created hopes, users who may be vulnerable to certain design features of the app can experience bad outcomes in various dimensions of their well-being, since their hopes license them to engage with the apps; other users may be disappointed because the actual use of the apps in their own non-optimal social setting does not bring about the advertised and hoped-for benefits. Our thesis is that providers of mHealth apps inflate or create false hopes, thereby increasing structural injustices that sustain or exacerbate the vulnerable or disadvantaged position of such user groups which are caused by the disappointed hopes and the reasons that lead up to this disappointment. Inflated hopes are created beliefs about the probability of an outcome that is rendered more certain than warranted, whereas false hopes suggest an outcome without any evidence and result from misinformation, misunderstanding, or deception.

Structural injustices result from two possible causes that are relevant to mHealth apps: systematic disadvantages that affect social groups and unfair power relations that sustain or exacerbate patterns of disadvantage through subordination, exploitation, and social exclusion from valuable social practices (Powers & Faden, 2019). Thus, the hopes created by the providers of commercial mHealth apps for self-tracking press the question of whether the deployment and use of mHealth apps meet the requirements for qualifying as a just public health endeavor. Because we are concerned by public health interventions and the identification of moral wrongs that are a matter of justice, we will not discuss the moral significance of disappointed hopes regarding the realization of optimal health, maximal lifespan, or detailed quantitative self-knowledge.

We aim to provide a starting point for various stakeholders to actively manage the hopes they create to avoid negative consequences for vulnerable or disadvantaged user groups. Stakeholders for whom this study is intended include all those involved in the development, dissemination, deployment, and regulation of mHealth apps. We directly address developers of mHealth apps, as we investigate what their responsibility is in the development and marketing of such apps. Our argument extends to vendors and distributors due to their responsibility in selecting and recommending the products they sell. Moreover, our study is relevant for healthcare providers and consultants who may recommend such apps and businesses or medical facilities that choose to deploy such mHealth apps for employees or patients.

In the first section, we will show how the promises created by the providers of commercial mHealth apps for self-tracking result in hopes for their users. Moreover, we will argue that the providers of mHealth apps often inflate or create false hopes that lead to disappointment for their users. In the second section, we will elaborate on the conception of hope that we use to analyze the normative ramifications of disappointed hopes. In the third section, we will establish the connection between the hopes, structural injustices, and the consequences for vulnerable or disadvantaged user groups. In the fourth section, we will discuss the extent to which the providers of mHealth apps are responsible for creating such hopes and the consequences for vulnerable or disadvantaged users. In the last section, we will suggest various measures providers of mHealth apps could engage in to manage the negative consequences of inflated and disappointed hopes and to mitigate the resulting structural injustices.

2 Creating and Disappointing Hopes

Commercial mHealth apps for self-tracking are apps that allow for the recording, storing, analysis, and transfer of health-related data to achieve a health benefit for the user and to allow for the monetization of the data for the provider. Health-related data primarily refers to data that captures physical parameters of the user's body, such as heart frequency, weight, calorie intake, menstrual cycle, blood oxygen, or insulin level. Often, such apps rely on wearable sensors for recording this data while health-related data can also be collected from a mobile device's inbuilt sensors, such as the accelerometer or GPS sensor. This allows the apps to track, for instance, the user's exercise regime, and to derive more health-related data.

We argue that by advertising their products, providers of commercial mHealth apps create hopes for their potential and actual users. The hopes created by the providers result from the promises providers make in the various modes of advertising their products. It is reasonable to assume that users take up those promises, because they are reflected in their expectations toward mHealth apps. The promises of the providers often result in inflated and unjustified or disappointed hopes for the users. The hopes, however, determine how users engage with the products. Moreover, disappointed hopes bear negative consequences for the users if they are already subject to various vulnerabilities since they frustrate the desire to achieve sufficient well-being and to lead a decent human life. This bears the risk of sustaining and manifesting unfair patterns of disadvantage and thus can increase structural injustice.

We focus on two classes of vulnerable or disadvantaged groups with different vulnerabilities in relation to Health apps. First, we focus on groups whose vulnerabilities emerge from digital inequalities, in particular unequal competency to make use of digital tools and infrastructure and claim their benefits. Second, we focus on groups whose vulnerabilities emerge from medical inequalities. These are members of social groups that are traditionally underserved by the medical establishment, because they deviate from medical standards and/or because of socioeconomic inequalities and social prejudices such as sexism, racism, ageism, or ableism. Medical inequalities such as, for instance, the underdevelopment of diagnosis and treatment methods for women are closely connected to broader social inequalities. We limit our argument to the vulnerabilities emerging from digital and medical inequalities because they are most urgent in the context of mHealth.

We investigated the hopes that the providers create by studying the promises made on the providers' websites. Websites are a valuable source of information because they often entail different advertising formats like blogs, videos, or user statements. Moreover, the information presented on the websites is often shared via social media channels and therefore reaches a great variety and number of potential users. Although we did not conduct a comprehensive study, we focused on apps that are paradigmatic for commercial mHealth apps that include self-tracking. The apps we included in this study are the *Fitbit* app for fitness tracking, the *Airse* app for tracking weight loss, and *Flo*, the most widely spread app for period tracking. This allows us to cover two categories of apps: companion apps to wearables and stand-alone apps. Apps, like the *Fitbit* app, are used as a companion to wearable devices that allow for comprehensively recording health-related data. The users purchase the wearable and can access a limited version of the app for free or purchase premium accounts that grant access to video workouts or additional features to foster the creation of healthy habits. *Flo* and *Arise* are stand-alone products for which users purchase premiums too. *Arise* allows to feed in data from wearables; this, however, is not necessary to use the app. The promises we focus on are targeted at the end-users and connect to the end-users' goal of self-managing their health by self-tracking.

Users vary in the extent to which they hope for a certain outcome resulting from using mHealth apps, since there are different categories of users. Some users, for instance, might want to manage a chronic illness, while others may want to improve their general health. Yet, others might hope for better looks. For hopes to be disappointed and ultimately result in increased structural injustices, it is important that the hopes of the users are sufficiently weighty in the sense that the hoped for outcome is expected to be transformative for the hoper's life and results in a benefit to their well-being to the extent that they achieve sufficient well-being to lead a decent human life. However, the weight of such hopes may fall short of health conditions that are a matter of life and death, such as hopes generated by a clinical trial for a lethal disease explored by Snyder in his book *Exploiting Hope* (2021). Moreover, as Snyder argues, hoping entails a certain risk or leap of hope that creates a vulnerability for the hoper. In the case of mHealth apps, users might, for instance, take a financial risk to possibly benefit from the app's use and forgo other possible ways of addressing their health problems or increasing their well-being. Providers of mHealth apps can exploit such vulnerabilities by inflating their users' hopes or by creating false hopes. Thus, the potential of the hopes created by the provider to entrench structural injustices depends on how weighty the hopes are for the respective user group and the risk involved in choosing that mHealth option.

Providers of mHealth apps often promise empowerment to their users as the overarching effect of their products. *Fitbit* states on its blog that smart technologies for self-tracking help their users to become increasingly empowered to make healthy lifestyle decisions (McMullen, 2018). Through self-tracking, the users can gain insights into their health status and develop healthy habits and exercise regimes. Moreover, the users can share insights gained through the app with health professionals; this increases the users' empowerment within the doctor-patient relationship.

The literature knows several definitions of "empowerment" (Burr & Morley, 2020; Morley & Floridi, 2019; Tengland, 2008). Per-Anders Tengland offers a useful distinction between empowerment as a goal and empowerment as a process. Empowerment as a goal refers to the control over one's determinants of life quality, whereas empowerment as a process means to create a professional relationship where an individual or group gains control over a change process, as for instance in political contexts or within a doctor-patient relationship (Tengland, 2008). Here, we argue mHealth discourse depicts empowerment as a goal and as a process.

Let us start with empowerment as a goal. The providers of mHealth apps promise that the users will gain control over the course of their life by using the apps. This promise is central to many mHealth applications. The design of the apps encourages the users to develop healthy habits, engage in exercise, and ultimately make healthier decisions that are in the users' best interest. Although the liberty of the users might be limited due to the choice architecture and gamification mechanisms of the apps, the users voluntarily accept this limitation to pursue a greater life goal.

The empowerment achieved through the choice architectures of the apps implies liberty in Millian terms. Mill conceptualizes liberty as the freedom of an individual to develop their own life plan, even if this includes accepting limitations to certain freedoms to achieve this goal (Powers et al., 2012). Thus, the limitation of the users' freedom, caused by the choice architectures of the apps, might support the realization of the users' long-term goals and thus support their liberty. Therefore, providers of mHealth apps promise empowered as liberty in the Millian sense.

Let us turn now to empowerment as a process. *Fitbit*, for instance, promises increased insights into the users' health status, alongside the potential health benefit. This result is due to a feature embedded in the app that records and analyzes data collected by the wearables that users can connect to the app. On their blog, *Fitbit* state "And now, *Fitbit* can help empower you to make the right decisions for your body. The new Daily Readiness Score […] helps you understand what's best for you—your readiness to take on exercise, or recovery, each day, based on your activity, heart rate, and sleep" (Fitbit Staff, 2021). Daily Readiness Score pointed toward personalized health and optimization.

The promise connects the insights the users can gain to increased health and empowerment. The app allows the users to access important information about their health status and to make new discoveries concerning their health. The providers promise to the users that they will benefit from this information by, for instance, checking suggested health decisions by their practitioners, to trial the effectiveness of a broader variety of potential treatments, and to find a personalized approach to achieving their health goals. This is one of the goals of the members of the Quantified Self movement, too, who use self-tracking technology for the purpose of self-discovery (Neff & Nafus, 2016). By promising new insights, providers promise empowerment in Tengland's second sense, as increased control within a change process.

Commercial mHealth apps for self-tracking, such as the weight loss app *Arise*, promise health, well-being, and long-terms results. The provider states on their website: “Your advantages: Feel healthier and more attractive every day. Permanent, lasting results without the yo-yo effect. Get amazing results in little time.”[2] Here, the provider promises that the users can count on positive long-term effects on their health, well-being, and attractiveness. The provider promotes the view that health, well-being, and attractiveness result from weight loss. Aside from users for whom high weight is a health risk, as for diabetes type II patients, the provider extents the scope to potential users who aim to achieve idealized body types, rather than improving their health.

Because mHealth apps collect and analyze intimate health-related data, providers promise control over the processed information. On the website of the most widely distributed period tracker, an app called *Flo*, this promise appears as a main feature of the app. “Discuss sensitive topics. Anonymously. Secret chats [sic] is a safe space where you can discuss intimate topics, ask questions and get support from other Flo community members.”[3] This promise creates an atmosphere of trust to share sensitive information with the app and the app’s support team. Hereby the provider promises privacy. On their website, Flo states that “[a]t no time has Flo ever sold user information, nor have we ever shared it with third parties for advertising purposes” (Flo, 2023b). Moreover, they present high data protection standards and especially advertise data protection and full transparency to German users (Flo, 2023a) who, unlike American users, are protected by the European data protection regulation (GDPR). The users hope to achieve privacy because they can share information anonymously and safely. This implies that the control over the shared information is left with users. Obtaining this control is important since the information stored on the app touch on very intimate and personal topics and pose high potential for misuse.

Because there is little research on whether users believe in these promises and form according hopes, we put forward a hypothetical argument to be tested in empirical studies. We hold that if we can assume that users adopt the hopes created by the providers and that hopes have an impact on usage modalities, there is a risk for the well-being of vulnerable groups which increases structural injustice. We think, however, that there are good reasons for provisionally accepting this premise since, in general, it is reasonable to assume that advertising achieves at least partly the objective of persuading potential users to purchase a product which is commercially successful. Moreover, the promises made by the providers are reflected in the expectations users have toward mHealth apps. This becomes evident from various studies. For instance, alongside the obvious expectation of improved health outcomes, easy to use design, and low costs, American users with various types of health conditions, including vulnerable or disadvantaged user groups, expect to achieve a significant level of independence and autonomy in managing their illness (Singh et al., 2022). Moreover, they expect the apps to comply with privacy standards and include data protection measures (Vo et al., 2019; Woldaregay et al., 2020).

---

[2] Arise website: https://www.arise-app.com/, accessed: 25 Oct 22.

[3] Website of Flo: https://flo.health/, accessed: 25 Oct 2022.

Expectations, however, differ from hopes. To hope for a desired outcome requires less certainty than expecting it, in the sense that neither users need to perceive the desired outcome as likely nor does the outcome have to be objectively likely. Moreover, expecting an outcome does not imply that the outcome is desirable. In the case of hoping, however, users attach special weight to the outcome in the sense that they believe the outcome will have a positive transformative effect on their life.

In the case of mHealth apps, only little evidence about the causality between their use and the expected outcomes is available. Many mHealth app developers include multiple behavior change strategies in their apps (12 on average), to convince a broader range of users (AlSlaity et al., 2022). Thus, it is difficult to study which strategy for behavior change is the most effective and results in the best outcomes for the users (AlSlaity et al., 2022). It seems that providers of mHealth apps are not primarily concerned with the effectiveness of their product; they rather offer a variety of different methods the user can engage with and hope that this will cause positive results for their users. Thus, it remains unclear for the users whether mHealth apps have the capacity to cause better outcomes in terms of health, independence, or health literacy (in the sense that they increase their users' ability to find, understand, and use important health information and services).

That users hope for a desired outcome and are disappointed by the actual results can be inferred from the low retention rates of mHealth apps. The use of most mHealth apps declines quickly over the course of approximately six months (Chan et al., 2018). The largest study conducted used the data of 1,011,008 users of a commercial weight loss app, called *Loose it!* [sic]. The study found that 45% of the users quit after only 3.6 days. After 176 days, only 3% of users kept using the app (Serrano et al., 2017). Other studies have confirmed this trend (Chan et al., 2018). Although there is little evidence about the effectiveness, the users share a certain attitude that, for them, justifies the engagement with the app. The users desire to be more healthy, attractive, independent, etc. Although the probability of achieving this outcome is objectively low or at least obscure, they use the desire for the outcome to justify engaging with the apps.

As we will argue in the following section, hope serves as a justifying attitude to engage in certain actions and thoughts. This means that the users are justified to engage with the apps, although they cannot be sure whether using the app will result in the desired outcome. The extent, however, to which this motivational aspect manifests for the users, is determined by external factors that are beyond the users' control and are rooted in the users' level of disadvantage regarding digital and medical inequalities. Moreover, the extent to which the hope persists depends on whether the providers of mHealth apps create justified, false, or inflated hopes. Whenever hopes turn out to be false or inflated because the provider of an app is unable to keep the promise previously made, it affects the motivational attitude of the user and eventually determines who is likely to benefit from mHealth apps and who will have to bear the additional burdens resulting from their use.

3 What Is Hope?

In *How We Hope* (2014), Adrienne Martin presents a comprehensive theory of hope. Martin explains in great detail why orthodox conceptualizations of hope discussed in the present and past run short in explaining why it is rational to hope for a desired outcome even if it is very unlikely or would amount to overcoming a profound challenge (Martin, 2014). The orthodox definition of hope suggests that to hope means to desire a certain outcome, while assigning some probability to it. This probability might be rather small; however, the hoper must assume that it is true (Martin, 2014, p. 13). Following this definition of hope, it would be irrational to invest cognitive resources, emotions, or certain actions into the desire for a highly unlikely outcome or an outcome that would amount to overcoming a vastly profound challenge.

Martin rejects the orthodox definition of hope for two reasons. First, the desiring of an outcome seems inadequate to accommodate the experience of hope since it often seems much more profound than mere desire: "…hope seems to color our experience in a way that is both richer and more specific than does desire" (Martin, 2014, p. 5). Moreover, hope is uniquely supportive in difficult times. This aspect points out a special motivational feature of hope that seems not to be included in simple desire.

Martin's conception of hope, which she calls the incorporation view, suggests that the desire for an outcome combined with the ascription of a certain probability serves as a justification to engage in thoughts, emotions, or actions aiming at bringing the desired outcome about. This "licensing stance" not necessarily includes any investment into bringing the desired outcome about. Rather, it licenses certain attitudes of the hoper that might lead to thoughts, feelings, or actions targeted at bringing the desired outcome about. Even if the desired outcome is unlikely, or might amount to having to overcome enormous obstacles, hoping cracks open the door to attitudes or actions possibly resulting in the increased probability of the outcome. Although desire insufficiently explains the concept of hope, Martin does not reject desire being an important part of hope. Afterall, desire initially defines the aspiration hope as well as the feelings, actions, and thoughts it justifies are directed at.

Naturally, hoping also includes the possibility of being disappointed, either by the circumstances or by the person whose actions or decisions would cause the fulfillment of the respective desire. To specify a relationship of responsibility between the hoper and the agent who can potentially fulfill the hoper's desire, the question arises which of the hoper's desires are morally significant in the sense that they bear enough normative strength to justify a moral obligation to realize the desire as a matter of justice in the context of public health interventions. We suggest that only those desires are morally significant as a matter of justice which are directed at a decent human life, meaning that the hoper desires sufficient well-being, including not being exposed to a significant risk to their well-being, in one or several aspects of their life. This, for instance, includes the desire of the patient to become well that causes them to invest hope in their practitioner while creating a moral responsibility for the treating practitioner to bring this outcome about. In contrast, our approach excludes the desire for optimal health, maximum lifespan, or detailed quantitative self-knowledge from the realm of moral significance for justice. These hopes fail to create an obligation of justice, since the fundamental aspects necessary for the hoper's sufficient level of well-being are not depending on their satisfaction. In this paper, we remain agnostic as to whether these hopes have moral significance or can be unduly exploited, for instance.

Moreover, the set of morally significant desires is limited by the societal background theories that formulate common beliefs rendering the morally significant desires and the means to meet them intelligible and adequate (Segers et al., 2022). In other words, desires are only morally significant if they aim at bringing the desired outcome about by intelligible and adequate means. For instance, desiring to become healthy is only morally significant once health is desired to be realized by medical treatments, other methods, and lifestyle practices that are commonly and plausibly viewed as adequate and intelligible and not by, for instance, performing a sacrificial ritual. Thus, we avoid the objection that others have the responsibility to realize the hoper's desire for sufficient well-being by enabling them to perform an activity such as counting leaves of grass (in Rawls' famous example).

4 Hopes and Structural Injustice

MHealth apps have been criticized for posing the risk of entrenching already existing digital inequalities (Bol et al., 2018). Digital inequalities describe the extent to which potential users are able to access digital tools as well as their capacity to use them, their actual usage, and their motivation (Bauer, 2003; Baur, 2008; Brall et al., 2019; Gómez-Ramírez et al., 2021; Jokinen et al., 2020; Paldan et al., 2018; Sethi et al., 2012; Van Dijk, 2020). While empirical research on the effects of the digital divide on the use of mHealth products has focused on the access to this technology in the past, it recently shifted its focus on the question of how digitally disadvantaged groups use mHealth apps and whether they are able to benefit from their use. Evidence suggests that inequalities in terms of digital competency and health literacy mitigate the benefit of digital health tools for digitally disadvantaged groups, for instance, the degree of successful self-management of healthcare needs (Neter & Brainin, 2012). In the case of mHealth apps, a representative study on the Dutch population suggests that the degree of beneficial use of mHealth apps depends on a variety of demographic factors such as age, level of education, and e-health literacy (Bol et al., 2018). This implies that digitally underserved populations are not only excluded in their access to the technology, but also in their ability to benefit from it when they have access to mHealth apps because of other disadvantages.

These criticisms imply an understanding of social justice as structural justice. Following Powers and Faden (2019), we understand structural injustice as unfair relations of power that sustain or entrench patterns of disadvantage over entire groups, as well as systematic disadvantages that have other sources. Structural justice is different from distributive justice, which is concerned with the fair distribution of primary social goods such as freedoms, powers, income, and wealth. Distributive justice is more concerned with outcomes, whereas structural justice is more concerned with the processes that lead to unjust outcomes, specifically the fairness of the underlying structures of a society.

The worry that the deployment of mHealth apps might entrench digital inequalities and increase the vulnerability of digitally disadvantaged user groups is not so much directed at how the access to mHealth apps should be distributed across society under ideal circumstances. Rather, it increasingly points out that the same social structures that result in less education, health literacy, etc. for some also prevent disadvantaged groups from realizing the benefits of mHealth apps. This means that disadvantages tend to cluster for groups that are not faring well in a variety of life aspects.

Disappointed hopes created by the providers of mHealth apps contribute to structural injustice since justice requires the sufficient fulfillment of core elements of well-being for all members of society (Powers & Faden, 2019). The core elements composing Power's and Faden's conception of well-being include health in terms of biological functioning and absence of disease, equal respect in terms of equal moral status, self-determination in terms of the ability to develop an authentic life plan, social attachment in terms of being embedded in social relationships, personal security in terms of the absence or threats to bodily and mental harm, and knowledge and understanding in terms of being able to develop heuristics and skills to understand and navigate the social and natural world.

Powers and Faden do not conceptualize well-being as a prescriptive requirement for leading a decent human life, instead the deprivations in any of the core elements of well-being point toward structurally unjust circumstances (Powers & Faden, 2006, p. 29). Moreover, their conception of well-being is limited to the purpose of evaluating social institutions and social arrangements, rather than presenting a normative claim about how to live well. Their account of well-being thus aims at specifying which inequalities matter most and what the obligations of societal stakeholders are to mitigate them.

Powers and Faden offer a taxonomy of structural injustices that consists of deprivations of well-being to the level of insufficiency, systematic disadvantages, and unfair power relations. Unfair power relations can occur as exclusion of groups from valuable social practices, as the domination of groups, or as the exploitation of groups. We focus on the impacts the created hopes have on systematic disadvantage and unfair power relations. Deprivations of the dimensions of well-being are indirectly present in both forms of structural injustices since they are a necessary condition for an instance of systematic disadvantage or unfair power relation to become a matter of injustice.

Scholars have argued that the use of mHealth apps can exacerbate vulnerabilities. Users with an eating disorder can develop a strong dependency on mHealth apps that limits their degree of self-determination (Jacobs, 2020b; Rossmaier, 2022). Apps that promise to decrease weight and to increase the users' attractiveness are appealing to potential users with eating disorder because they present a feasible way to achieve idealized body types. This is especially true for female college students in the US where 13.5% of undergraduate women are diagnosed with eating disorder (Eisenberg et al., 2011) and 40–49% of women at universities engage in behavior associated with eating disorder at least once per week (Berg et al., 2009). Eikey and Reddy (2017) argue that the high numbers of cases of eating disorder, especially among young women, are the result of socially promoted ideal body types. As Eikey (2021) argues further, this puts them more at risk of experiencing exacerbations of eating disorder or associated behavior caused by the use of mHealth apps for self-tracking which are heavily advertised among college students.

The apps nudge users to continuously engage with the app, which may exacerbate the users' eating disorder (Sharkey, 2018). This has negative effects on the users' self-determination, because they might not be able to stop using the app. In fact, dependency on the app and obsessive use are one of the consequences of the use of mHealth apps among people with eating disorder (Eikey, 2021). This, however, adds to the level of systematic disadvantage of such users (Rossmaier, 2022). Using such apps affects the users physical and mental health, which results in impacts on the users' capacity to lead a self-determined life. This systematically disadvantages users with eating disorders since their worsened condition bleeds into other aspects of their lives and thus lowers their general ability to fare well in life.

The exclusion of users who are subject to digital inequalities and the exacerbation of the users' vulnerabilities are morally problematic not because the use of mHealth apps impacts only one dimension of well-being. In all cases, direct or indirect impacts are such that they affect multiple dimensions of well-being. Thus, the joint impacts on the dimensions of well-being create and contribute to unjust structural circumstances that affect multiple areas of the users' lives.

Unfair power relations in terms of excluding user groups from benefitting from mHealth apps occur on two levels. First, public health organizations encourage the universal use of mHealth apps (European Commission, 2014; World Health Organization, 2011), despite knowing that digitally disadvantaged groups might be excluded. Excluding digitally disadvantaged groups from the benefits of mHealth apps becomes unjust, and thus morally problematic, if the exclusion implies insufficiency within any of the core elements of well-being. We suggest that this can be the case, as was the case during the COVID-19 pandemic when mHealth apps became an important way of accessing health services (Khilnani et al., 2020). Many users downloaded mHealth apps for improving their mental health and coping with mental health issues that resulted from the measures to mitigate the spread of the virus (Nobles et al., 2020). In situations where mHealth apps are important for the delivery of such health services, not being able to realize those benefits can create an additional health risk due to a lack of alternatives. A study conducted in 130 countries by the World Health Organization showed that mental healthcare systems were overburdened by the rapid increase of demand for mental health services due to the pandemic (World Health Organization, 2020). Like most of the population worldwide, the mental health of digitally disadvantaged populations was impacted by the pandemic. Like the majority, digitally disadvantaged groups had less opportunities to access traditional mental healthcare due to the increase in demand; unlike digitally privileged populations, however, they were unable to benefit from unlimited mental health services provided by mHealth apps.

Second, providers of mHealth apps contribute to the exclusion of groups who are digitally disadvantaged but are able to access and use digital tools, when they advertise their product to potential users who are insufficiently skilled to use their products, have problems using the technology, or lack motivation. They create the hope that their users can realize all the potential benefits of mHealth apps, while for some groups this is not possible due to their disadvantaged position. The comprehensive study on the weight-loss app Loose it! [sic] showed that the 3% of users who kept using the app after 176 days were those who made use of the customization features of the app, meaning that they engaged in personalized exercise and logged customizable meals (Serrano et al., 2017). Often, such functions are only available to those who can afford premium subscriptions and the timely resources to precisely log their activities. Moreover, being able to make use of advanced settings requires more digital literacy.

The exclusion of digitally disadvantaged groups is unjust because it prevents them from participating in a potentially valuable social practice. There is a general tendency within the healthcare system to increasingly offer digital solutions in a variety of different areas including the prevention of health risks, diagnosis, treatment, health research, and administration. It is thus likely that being able to navigate this digital world will become increasingly crucial. Groups who are excluded from this practice are deprived of the useful knowledge and understanding that using the device potentially enables. Moreover, they are excluded in situations where using digital tools might be the only option. This is morally relevant since Powers and Faden state that "[s]ufficiency for any dimension of well-being will be relative to the level of social organization and technological and scientific development in which that dimension must be realized." Therefore, excluding groups from the use of mHealth apps is unjust, since engaging with this technology might become a necessity for navigating the health system, access health information, and request health services.

Unfair power relations in terms of domination become visible in relation to the promise of privacy. As we have argued above, fertility trackers pose a high risk to infringe their users' privacy. Women who share intimate data with fertility trackers, such as *Flo*, are at risk of legal persecution in states where abortion is illegal. This is the case, for instance, in the USA, where some states prohibit abortion. There, women have to fear that information shared with the app might be used against them in criminal court cases (Garamvolgyi, 2022). In view of the untransparent data protection agreements of many apps, this is a possible scenario. Moreover, although Flo presents itself compliant with high privacy standards, the Federal Trade Commission issued a complaint in 2021, because Flo has shared sensitive data with marketing and analytics firms including Facebook and Google (Federal Trade Commission, 2021). The hope that their data will be handled with care promotes trust in the product while disappointing the promise and can have severe effects on the users' well-being. This case shows that hopes cannot only be inflated by the providers of mHealth apps, they can also be deceptive.

In the case of fertility trackers, disappointing the hope for privacy deprives the users of self-determination. This is problematic in cases, where women's self-determination is already under attack. Simultaneously, it has implications for the women's physical and mental health and the degree of respect in terms of equal moral treatment. It is not the case that using the app alone produces the deprivations of the dimensions of well-being. The apps, however, bear great potential to exacerbate and increase already unjust social structures. This is especially the case, when inflated hopes cause vulnerable or disadvantaged users to engage with mHealth products but result in the disappointment of the hopes.

The providers of mHealth apps often benefit in an exploitative way from their users' vulnerabilities, in the sense that they take unfair advantage of those vulnerabilities. In many cases, their business model is centered on the trade with collected user data (Sax, 2021). They share data with third parties, such as advertising companies, research facilities, or governmental bodies. The conditions for a successful app are thus that users engage with the product continuously over long periods (Sax, 2021). People with eating disorder are, from an economic perspective, desirable users, since they can develop an addictive mode of using the app. The same is true for people with exercise addiction.

Benefiting from the vulnerabilities of such user groups and potentially adding to their level of vulnerability constitute a structural injustice. We suggest, however, that it is not necessarily the providers of mHealth apps who intentionally exploit the vulnerabilities of, say, users with an eating disorder. Rather, it seems to be the case that the apps' design combined with the data-centered business model leads, intentionally or not, to exploitative circumstances. Thus, mHealth apps providers either benefit from or add to the background conditions that cause structural injustices.

An objection to this view is that the providers of mHealth apps can never know the extent to which the hopes they create, for instance, through marketing campaigns, will affect potentially vulnerable users. Nor are they in any way responsible for the vulnerabilities of certain user groups since they did not contribute to the social problems that caused them. Moreover, they do not cause digital inequalities, since digital inequalities often result from bad social policy decisions. Rendering providers responsible for those inequalities would mean that the providers of mHealth apps become responsible not only for mitigating the causes of eating disorder or exercise addiction but also for an exuberant number of other circumstances linking to those problems. Those problems, they can never hope to address comprehensively.

The main intention of sufficientarian theories of justice, like the one presented by Powers and Faden, is, however, to argue that to be able to judge a policy, a social, or economic circumstance as just, it must result in the correct amount of the correct type of benefit (Fourie, 2017). Stakeholders who have an impact on the level of equality within a society have the obligation not to put in place measures that hinder or actively undermine the achievement of sufficiency. In the context of health and public health, this includes private stakeholders (Powers & Faden, 2006). Thus, providers of mHealth apps are not responsible for the vulnerabilities of their user groups. They do, however, have the obligation to implement measures that do not prevent users to achieve a sufficient level of well-being.

5 Hope and Responsibility

To present feasible solutions for providers to contribute to the mitigation of structural injustices linked to the deployment and use of mHealth apps, it is necessary to establish a conceptual relationship between the hopes they create and the responsibility they bear. Thus, we ask: Can we hold the providers of mHealth apps responsible for the hopes they create and thus the negative consequences that false or inflated hopes might have on vulnerable or disadvantaged user groups?

To provide an answer to this question, we draw on Snyder's theory of hope exploitation (2021). Snyder's theory rests on the assumption that to hope, in the sense of Martin, includes that the desired outcome is weighty to the hoper. This means that the desired outcome is expected to have a transformative impact on the hoper's life, in the sense that it will positively affect their well-being. In context of Powers and Faden's theory, the weightiness of the hope results from the desire for sufficient well-being. For instance, somebody who uses an mHealth app to manage their chronic illness hopes that the app will positively impact their health and thus significantly improve their well-being. This hope is morally significant as a matter of justice since the hoper hopes for their health to reach toward sufficiency while at the same time the means by which they hope this outcome will be achieved are both adequate and intelligible given our societal background theories about what are adequate and intelligible ways to improve one's health.

This weightiness, however, creates a certain vulnerability for the hoper. Snyder argues that the hoper is willing to take a leap of hope; in other words, they must take a risk since they put trust in whatever they hope to bring the desired outcome about. In the example of the app, the user displays trust in the provider of the app by providing sensitive health-related data, by paying for a premium subscription or by following the app's suggestions to alter their behavior. This trust, however, renders the user vulnerable to the provider since they might intentionally inflate the hope of the user or create false hopes to gain some benefit.

Snyder argues that this creates the risk for the hoper to be exploited since the hoper becomes vulnerable to be used as a mere means to an end. In the case of mHealth apps, this end would be, for instance, a financial profit for the provider. Snyder argues that the entrusted has a duty of beneficence toward the hoper. The Kantian duty not to use others as a mere means to an end results in a duty of respect that the entrusted has to fulfill toward the hoper. This duty of beneficence consists of the acknowledgment of the hoper's interest in their own sufficient well-being that is necessary to lead a decent human life. This means that the moral wrong in exploiting hopes is a lack of respect for the hoper in the sense that the entrusted disregards the hoper's desire for sufficient well-being in order to gain an advantage. This is how we understand the disappointment of hopes for those who fare below sufficiency when it comes to their well-being.

Our argument, however, focuses on how the inflated or false hopes of the users lead to entrenched structural injustices and ultimately result in negative consequences for the users' well-being. Exploitation is not our only concern, since we argue that the background conditions for the hoper are not necessarily exploited by the provider. Rather, we think that aside from intentionally inflated or deceptive hopes, *carelessly* created hopes can negatively impact the well-being of vulnerable users too.

This is because users are seemingly justified in hoping for certain outcomes of the use of mHealth apps, not only because of the created hopes of the providers, but also because those hopes are backed up by institutional underlying circumstances, which renders the underlying desire of the hoper morally relevant since it is backed up by what is commonly promoted and perceived as an intelligible and adequate approach to, for instance, improve one's health or health literacy.

Public organizations, like the WHO or the European Commission, support the deployment of mHealth apps because the realization of its benefits seems an attractive solution to present and future public health challenges. In their Global Strategy for Digital Health 2020–2025, the WHO states that "The vision of the global strategy is to improve health for everyone, everywhere by accelerating the development and adoption of appropriate, accessible, affordable, scalable and sustainable personcentric [sic] digital health solutions…" (World Health Organization, 2021) to prevent a variety of different public health risks such as pandemics or wide-spread chronic illnesses and to utilize the collected data for health research. To achieve this goal, the WHO has implemented mechanisms to monitor the implementation of the strategies of its member states to increase innovation and adoption of digital solutions within their respective health systems.

Moreover, health insurance providers, public or private, increasingly offer mHealth apps to their customers. In Germany, for instance, practitioners can prescribe certain mHealth apps to their patients on basis of the Digital-Healthcare Act (Digitale-Versorgungs Gesetz), adopted in 2019. The support from public institutions and the increasing number of public–private partnerships between mHealth app providers and public organizations thus lend credibility to the promises of the providers. Thus, actual and potential users are justified in their hopes by health authorities.

Thus, the duty of beneficence results in a responsibility on two levels. First, providers of mHealth apps have the responsibility toward users not to intentionally or carelessly inflate hope or create false hopes that can negatively affect the well-being of their users. They ought to create hopes only to the extent as is in their users' best interest. Second, public health organizations have the responsibility to stay realistic about the possible benefits of mHealth apps and be careful not to buy into the potential hypes and unrealistic promises made by the providers of mHealth apps.

6 Measures to Avoid the Negative Consequences of Creating Hopes

Finally, we want to answer the question of how providers can meet their responsibility not to disappoint or inflate the hopes of their actual and potential users who belong to disadvantaged or vulnerable groups. What are measures that contribute to mitigating the increases in structural injustice caused by the inflated hopes created by the providers of commercial mHealth apps? To address the six dimensions of well-being, it is important to implement measures aiming to achieve comprehensive results that can have a positive effect on multiple areas of the users' lives.

The first measure would be for the providers to meet the promises they make in their advertising campaigns. This requires a reflection on not only what is directly stated, but what is implied by these promises. In the case of the app *Flo*, the promise of confidentiality implies privacy without mentioning it directly. Value-sensitive design approaches could help to realize the promise of privacy for the users. In the case of mHealth apps, a framework for promoting the capabilities of the users has been presented (Jacobs, 2020a). To address, for instance, the risk of privacy infringements, such frameworks should include the capability to control one's own data and information and should be sensitive to the cultural variations (Dennis & Clancy, 2022).

Another option is to alter the advertising campaigns. This would include greater transparency on the risks connected to the apps' use. Transparent data protection agreements and terms of use, however, would only be one step to assure more transparence. Additionally, providers could display warnings on their products that direct the users' attention to certain risks, in case they belong to a group that is particularly vulnerable to experiencing negative consequences of the apps' use, such as people with eating disorder or exercise addiction.

Realizing this measure requires some degree of foresight to identify possible vulnerable or disadvantaged groups for whom the use of the apps might become problematic. An adequate foresight analysis would consider the potential benefits of an app not only under optimal conditions, but under real conditions. It could involve stakeholder discussions or studies with possible user groups.

The last option would be to offer a form of compensation to those who are excluded from the use of mHealth apps. Providers could offer compensation in form of campaigns aiming at mitigating digital inequalities by providing free, carefully designed training to increase the digital and health literacy of potential user groups. Moreover, supporting the expansion of inclusive digital infrastructures helps excluded users to realize the potential benefits of mHealth apps. One way of achieving this goal is to enter public–private partnerships. It needs to be added, however, that public–private partnerships, especially in the domain of public health, may undermine the integrity of public institutions (Marks, 2019). Therefore, such initiatives require careful consideration and public scrutiny during the development and deployment stages.

7 Conclusion

We have argued that the providers of mHealth apps create inflated hopes for actual and potential users. Such hopes create increased structural injustices for digitally disadvantaged and vulnerable populations. Moreover, the providers of mHealth apps bear responsibility for the mitigation of the negative consequences of disappointed and inflated hopes. We suggest that they meet this responsibility by means of value-sensitive design, foresight analysis, and compensation measures.

Author Contribution LR: conception of the work, drafting the article, final approval of the version to be published. YS: critical revision of the article, drafting the article, final approval of the version to be published. PB: critical revision of the article, drafting the article, final approval of the version to be published.

Funding This project has received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement no. 813497.

Data Availability We do not analyze or generate any datasets, because our work proceeds within a theoretical and mathematical approach.

Declarations

Conflict of Interest The authors declare no competing interests.

References

AlSlaity, A., Suruliraj, B., Oyebode, O., Fowles, J., steeves, D., & Orji, R. (2022). Mobile applications for health and wellness: a systematic review. *Proceedings of the ACM on Human-Computer Interaction, 6*(EICS), 1–29. https://doi.org/10.1145/3534525

Bauer, K. (2003). Distributive justice and rural healthcare: A case for e-health. *The International Journal of Applied Philosophy, 17*(2), 241–252. https://doi.org/10.5840/ijap200317218

Baur, C. (2008). An analysis of factors underlying e-health disparities. *Cambridge Quarterly of Healthcare Ethics, 17*(4), 417–428.

Berg, K. C., Frazier, P., & Sherr, L. (2009). Change in eating disorder attitudes and behavior in college women: Prevalence and predictors. *Eating Behaviors, 10*(3), 137–142. https://doi.org/10.1016/j.eatbeh.2009.03.003

Bol, N., Helberger, N., & Weert, J. C. M. (2018). Differences in mobile health app use: A source of new digital inequalities? *The Information Society, 34*(3), 183–193. https://doi.org/10.1080/01972243.2018.1438550

Brall, C., Schröder-Bäck, P., & Maeckelberghe, E. (2019). Ethical aspects of digital health from a justice point of view. *European Journal of Public Health, 29*(Supplement_3), 18–22. https://doi.org/10.1093/eurpub/ckz167

Burr, C., & Morley, J. (2020). Empowerment or engagement? Digital health technologies for mental healthcare. In C. Burr & S. Milano (Eds.), *The 2019 Yearbook of the Digital Ethics Lab* (pp. 67–88).

Chan, Y.-F.Y., Bot, B. M., Zweig, M., Tignor, N., Ma, W., Suver, C., Cedeno, R., Scott, E. R., Gregory Hershman, S., Schadt, E. E., & Wang, P. (2018). The asthma mobile health study, smartphone data collected using ResearchKit. *Scientific Data, 5*(1), 1. https://doi.org/10.1038/sdata.2018.96

Dennis, M. J., & Clancy, R. F. (2022). Intercultural ethics for digital well-being: Identifying problems and exploring solutions. *Digital Society, 1*(1), 7. https://doi.org/10.1007/s44206-022-00006-2

Eikey, E. V. (2021). Effects of diet and fitness apps on eating disorder behaviours: Qualitative study. *Bjpsych Open, 7*(5), e176. https://doi.org/10.1192/bjo.2021.1011

Eikey, E. V., & Reddy, M. C. (2017). "It's definitely been a journey": a qualitative study on how women with eating disorders use weight loss apps. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, 642–654. https://doi.org/10.1145/3025453.3025591

Eisenberg, D., Nicklett, E. J., Roeder, K., & Kirz, N. E. (2011). Eating disorder symptoms among college students: Prevalence, persistence, correlates, and treatment-seeking. *Journal of American College Health : J of ACH, 59*(8), 700–707. https://doi.org/10.1080/07448481.2010.546461

European Commission. (2014). *Green paper on mobile health ("mHealth")*. Retrieved April 2, 2020, from https://ec.europa.eu/digital-single-market/en/news/green-paper-mobile-health-mhealth

Federal Trade Commission. (2021, June 22). *FTC finalizes order with Flo Health, a fertility-tracking app that shared sensitive health data with Facebook, Google, and others*. Federal Trade Commission. https://www.ftc.gov/news-events/news/press-releases/2021/06/ftc-finalizes-order-flo-health-fertility-tracking-app-shared-sensitive-health-data-facebook-google

Fitbit Staff. (2021, November 9). Daily readiness on Fitbit premium can help empower you to make the right decisions for your body. *Fitbit News*. https://blog.fitbit.com/daily-readiness-score/

Flo. (2023a). *Flo—Ovulationskalender, Periodentracker und Schwangerschaftsapp*. Flo.health - #1 mobiles Produkt für die weibliche Gesundheit. Retrieved January 31, 2023, from https://flo.health/de

Flo. (2023b). *Privacy Portal*. Flo.Health - #1 Mobile Product for Women's Health. Retrieved January 31, 2023, from https://flo.health/privacy-portal

Fourie, C. (2017). The sufficiency view: A primer. In C. Fourie & A. Rid (Eds.), *What is Enough? Sufficiency, Justice, and Health* (pp. 11–29). Oxford Univ Pr.

Garamvolgyi, F. (2022, June 28). Why US women are deleting their period tracking apps. *The Guardian*. https://www.theguardian.com/world/2022/jun/28/why-us-woman-are-deleting-their-period-tracking-apps

Gómez-Ramírez, O., Iyamu, I., Ablona, A., Watt, S., Xu, A. X. T., Chang, H.-J., & Gilbert, M. (2021). On the imperative of thinking through the ethical, health equity, and social justice possibilities and limits of digital technologies in public health. *Canadian Journal of Public Health = Revue Canadienne de Sante Publique*, *112*(3), 412–416. https://doi.org/10.17269/s41997-021-00487-7

Jacobs, N. (2020a). Capability sensitive design for health and wellbeing technologies. *Science and Engineering Ethics, 26*, 3363–3391.

Jacobs, N. (2020b). Two ethical concerns about the use of persuasive technology for vulnerable people. *Bioethics, 34*(5), 519–526. https://doi.org/10.1111/bioe.12683

Jokinen, A., Stolt, M., & Suhonen, R. (2020). Ethical issues related to eHealth: an integrative review. *Nursing Ethics*. 28(2), 253–271. https://doi.org/10.1177/0969733020945765

Khilnani, A., Schulz, J, & Robinson, L. (2020). The COVID-19 pandemic: new concerns and connections between eHealth and digital inequalities. *Journal of Information, Communication and Ethics in Society*, *18*(3), 393–403. https://doi.org/10.1108/JICES-04-2020-0052

Marks, J. H. (2019). *The perils of partnership: Industry influence, institutional integrity, and public health*. Oxford University Press.

Martin, A. M. (2014). *How we hope*. Princeton University Press.

McMullen, M. (2018, November 26). Smart tech that can improve patient empowerment. *Fitbit Health Solutions*. https://healthsolutions.fitbit.com/blog/smart-tech-that-can-improve-patient-empowerment/

Morley, J., & Floridi, L. (2019). The limits of empowerment: how to reframe the role of mHealth tools in the healthcare ecosystem. *Science and Engineering Ethics*, 1–25.

Neff, G., & Nafus, D. (2016). *Self-tracking*. MIT Press.

Neter, E., & Brainin, E. (2012). eHealth literacy: extending the digital divide to the realm of health information. *Journal of Medical Internet Research*, *14*(1). e19. https://doi.org/10.2196/jmir.1619

Nobles, J., Martin, F., Dawson, S., Moran, P., & Savović, J. (2020). *The potential impact of COVID-19 on mental health outcomes and the implications for service solutions*. ARC West. Retrieved December 19, 2022, from https://arc-w.nihr.ac.uk/covid-response/rapid-reports/potential-impact-of-covid-19-on-mental-health-outcomes-and-the-implications-for-service-solutions/

Paldan, K., Sauer, H., & Wagner, N.-F. (2018). Promoting inequality? Self-monitoring applications and the problem of social justice. *AI and Society*, 1–11.

Powers, M., & Faden, R. (2006). *Social justice. The moral foundations of public health and health policy* (1.). Oxford University Press.

Powers, M., & Faden, R. (2019). *Structural injustice: Power, advantage, and human rights*. Oxford University Press.

Powers, M., Faden, R., & Saghai, Y. (2012). Liberty, mill and the framework of public health ethics. *Public Health Ethics, 5*(1), 6–15. https://doi.org/10.1093/phe/phs002

Rossmaier, L. W. S. (2022). Commercial mHealth apps and unjust value trade-offs: a public health perspective. *Public Health Ethics*, phac016. https://doi.org/10.1093/phe/phac016

Sax, M. (2021). *Between empowerment and manipulation*. University of Amsterdam.

Segers, S., Pennings, G., & Mertes, H. (2022). Assessing the normative significance of desire satisfaction. *Metaphilosophy, 53*(4), 475–485. https://doi.org/10.1111/meta.12574

Serrano, K. J., Coa, K. I., Yu, M., Wolff-Hughes, D. L., & Atienza, A. A. (2017). Characterizing user engagement with health app data: A data mining approach. *Translational Behavioral Medicine, 7*(2), 277–285. https://doi.org/10.1007/s13142-017-0508-y

Sethi, R., Bagga, G., Carpenter, D., Azzi, D., & Khusainov, R. (2012). *Telecare: legal, ethical and socioeconomic factors*. Paper presented at International Conference on Telehealth, Innsbruck, Austria. https://doi.org/10.2316/P.2012.765-009

Sharkey, L. (2018, February 23). "A twisted comparison game": how fitness apps exacerbate eating disorders. *Vice*. https://www.vice.com/en/article/pammjn/a-twisted-comparison-game-how-fitness-apps-exacerbate-eating-disorders

Singh, G., Simpson, E., MacGillivray, M. K., Sawatzky, B., Adams, J., & Ben Mortenson, W. (2022). Expectations of a health-related mobile self-management app intervention among individuals with spinal cord injury. *Topics in Spinal Cord Injury Rehabilitation*, *28*(2), 205–215. https://doi.org/10.46292/sci21-00022

Snyder, J. (2021). *Exploiting hope: How the promise of new medical interventions sustains us -- and makes us vulnerable*. New York, NY: Oxford University Press.

Tengland, P.-A. (2008). Empowerment: A conceptual discussion. *Health Care Analysis, 16*(2), 77–96. https://doi.org/10.1007/s10728-007-0067-3

Van Dijk, J. (2020). *The Digital Divide*. Polity Press.

Vo, V., Auroy, L., & Sarradon-Eck, A. (2019). Patients' perceptions of mHealth apps: Meta-ethnographic review of qualitative studies. *JMIR MHealth and UHealth, 7*(7), e13817. https://doi.org/10.2196/13817

Woldaregay, A. Z., Henriksen, A., Issom, D.-Z., Pfuhl, G., Sato, K., Richard, A., Lovis, C., Årsand, E., Rochat, J., & Hartvigsen, G. (2020). User expectations and willingness to share self-collected health data. *Studies in Health Technology and Informatics, 270*, 894–898. https://doi.org/10.3233/SHTI200290

World Health Organization. (2011). *mHealth—new horizons for health through mobile technologies.* WHO Press.

World Health Organization. (2020). *COVID-19 disrupting mental health services in most countries, WHO survey*. Retrieved December 19, 2022, from https://www.who.int/news/item/05-10-2020-covid-19-disrupting-mental-health-services-in-most-countries-who-survey

World Health Organization. (2021). *Global strategy on digital health 2020–2025*. World Health Organization. Retrieved February 1, 2023, from https://apps.who.int/iris/bitstream/handle/10665/344249/9789240020924-eng.pdf