Zeitschrift für Ethik und Moralphilosophie
https://doi.org/10.1007/s42048-024-00203-3

SUBMITTED PAPER

Queering healthcare with technology?—Potentials of queer-feminist perspectives on self-tracking-technologies for diversity-sensitive healthcare

Niklas Ellerich-Groppe · Tabea Ott · Anna Puzio · Stefanie Weigold · Regina Müller

Received: 16 April 2024 / Accepted: 14 November 2024

Abstract Self-tracking-technologies can serve as a prominent example of how digital technologies put to test established practices, institutions, and structures of medicine and healthcare. While proponents emphasize the potentials, e.g., for individualized healthcare and new research data, opponents stress the risk that these technologies will reinforce gender-related inequalities.

While this has been made clear from—often intersectional—feminist perspectives since the introduction of such technologies, we aim to provide a queer-feminist perspective on self-tracking applications in healthcare by analyzing three concrete cases. In this way, we want to show why such a perspective is helpful in assessing

---

✉ Niklas Ellerich-Groppe
Division of Ethics in Medicine, Department for Health Services Research, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany
E-Mail: niklas.ellerich-groppe@uni-oldenburg.de

Tabea Ott
Chair of Systematic Theology II (Ethics), Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen-Nürnberg, Germany

Anna Puzio
Ethics of Socially Disruptive Technologies (ESDiT) Programme, Faculty of Behavioural, Management and Social Sciences (BMS), Philosophy (WIJSB), University of Twente, Enschede, Netherlands
E-Mail: a.s.puzio@utwente.nl

Leverhulme Centre for the Future of Intelligence, University of Cambridge, Cambridge, United Kingdom

Stefanie Weigold
Institute of Experimental Medicine, Medical Ethics Department, Christian-Albrechts-University Kiel, Kiel, Germany
E-Mail: stefanie.weigold@iem.uni-kiel.de

Regina Müller
Institute of Philosophy, University Bremen, Bremen, Germany

self-tracking technologies and how such a perspective might contribute to a queering of healthcare.

After a short introduction to self-tracking in healthcare and the corresponding risks of reproducing gender-related inequalities, we introduce queer bioethics as a methodology to examine structural discrimination and marginalization in bioethical research. We apply this framework in the analysis of three exemplary self-tracking applications from the areas of *nutrition/fitness, reproductive health,* and *mental health.* In the subsequent discussion of these results against the backdrop of already existing queer-sensitive technologies, we identify an equal access, a subversive design, an inclusive database, and a diversity-sensitive and discriminatory-critical definition of purposes as well as individualized usage possibilities as first possible starting points for a queering of self-tracking applications. Finally, we draw conclusions, how such a critical perspective on self-tracking applications might also contribute to a queering of the healthcare system at a structural level.

Keywords Self-tracking · Queer-feminism · Healthcare · Digitalization · Discrimination · Gender

1 Introduction

Self-tracking technologies can serve as a prominent example of how digital technologies put to test established practices, institutions, and structures of medicine and healthcare. Thus, self-tracking—defined as "[t]he permanent gathering and evaluation of self-related data in one's daily life [...] by using digital technologies" (Heyen 2020, p. 124)—is usually considered to have significant potential to transform healthcare regarding individualized healthcare and prevention, increased cost-efficiency, and the easy generation of new research data.

However, as initial critical assessments of self-tracking technologies demonstrate, the benefits are not distributed equally across populations. Instead, these technologies might exacerbate social inequalities and create problems of social injustice (Hendl et al. 2019, p. 77; Lucivero and Jongsma 2018, pp. 685–686; Paldan et al. 2018). For example, the money and time available for self-tracking technologies often correspond to socioeconomic status. Thus, self-tracking technologies tend to benefit those with more financial and time capacities (Charitsis 2019; Ajana 2018; Hendl et al. 2023). Beyond these class-related inequalities, other barriers, such as age-related differences in digital literacy, are frequently discussed examples of such impending inequalities (Chen et al. 2023). These examples illustrate that self-tracking technologies run risk of contradicting a diversity-sensitive healthcare system that provides appropriate therapies and care for everybody, and instead reinforce inequalities, particularly to the detriment of the health of already marginalized people.

As feminist analyses have made clear since the introduction of such technologies, these inequalities also include gender-related disparities and discrimination (Lupton 2014; Hendl et al. 2023). Thus, the increasing use of self-tracking devices runs risk of perpetuating the traditional bias of medicine and medical research on health conditions that mainly affect men, once again fueling imbalances and inequalities

(Hendl et al. 2019). Many feminist analyses address these aspects, particularly from an intersectional perspective (e.g., Dolezal and Oikkonen 2021; Hendl et al. 2019, 2023). This paper aims to contribute to a distinct queer-feminist perspective on self-tracking devices and their application in healthcare. First, we aim to demonstrate why such a perspective is helpful in the assessment of self-tracking technologies and the identification of related moral problems. Second, we want to show how this perspective can contribute to a queering of healthcare by providing first starting points for more diversity-sensitive self-tracking technologies that also consider the needs of LGBTQIA+ people (i.e., individuals identifying as lesbian, gay, bisexual, trans, queer, intersex, asexual or those not aligning with any of the existing categories).

To this end, we first provide an introduction to self-tracking in medicine and healthcare and demonstrate how self-tracking technologies can reproduce gender-related inequalities regarding access, design, database, and use/implementation (2). Then, we introduce queer bioethics as a methodology to examine structural discrimination and marginalization within bioethical research (3). We apply this methodology in an analysis of three exemplary cases of self-tracking applications from the areas of *nutrition/fitness, reproductive health,* and *mental health* (4). Finally, we discuss the results of our analysis in the context of already existing queer-sensitive technologies in healthcare (5) and draw conclusions about how such a critical perspective on self-tracking applications could not only contribute to a more diversity-sensitive digital health but also to a queering of the healthcare system at a structural level (6).

2 Self-tracking and gender in healthcare: Reproducing inequalities

As “the world of wearable devices has been connected to the world of health and well-being at its very onset” (Lucivero and Jongsma 2018, p. 685), these technologies are widely regarded as offering vast potential for healthcare, including, for example, the generation of new research data (Ajana 2018; Lupton 2014), potentials for personalized medicine, and health prevention and promotion (Erdmann et al. 2023; Prainsack 2017, 2018; Sharon 2017). Furthermore, self-tracking devices are seen to promise new opportunities for occupational health management (Charitsis 2019; Lupton 2014; Mämecke 2016, 2023) and, on a societal level, for behavior-based insurance rates (Ellerich-Groppe 2022; Mämecke 2023).

However, others have pointed to the risk that these technologies will reinforce or create health-related inequalities or discrimination. Besides racial discrimination (Willis and Neblett 2023), class-based inequalities (Ajana 2018, p. 4; Charitsis 2019, pp. 142–143; Hendl et al. 2023), and age-related barriers (Chen et al. 2023), this also concerns gender-related inequalities and discriminations. Indeed, drawing on the existing literature on mHealth and self-tracking technologies in healthcare and structuring it along the essential components of self-tracking technologies (for an overview, see Hendl et al. 2019, 2023; Paldan et al. 2018), one can distinguish gender-related inequalities regarding access, design, and database, as well as the implementation of such technologies in healthcare.

Regarding *access*, assumptions about prototypical users of self-tracking technologies with regard to their body, health, gender, and ability have a considerable influence (Dolezal and Oikkonen 2021). These assumptions influence the purposes of the app, often excluding gender-specific health challenges and needs. For example, the possibility of tracking menstruation was only later integrated into Apple Health, a tracking app pre-installed on iPhones and iPads (Hendl et al. 2019, p. 84). At first glance, this may not appear to restrict access to these applications. However, when we understand access not simply in terms of the general possibility to use any application but as the opportunity to use an application that meaningfully addresses one's health challenges and needs, we can identify a gender-related inequality regarding access that can have severe consequences for the health status of queer people. According to minority stress theory (Meyer 2003), this is particularly true because LGBTQIA+ face unique social stressors (e.g., homophobic victimization, gender non-affirmation) due to their stigmatized social status (relative to heterosexual populations). This stress increases the risk of adverse health consequences in various areas (Frost and Meyer 2023). Health disparities for sexual and gender minorities, stemming from exposure to stress, stigma, and discrimination, contribute to a significantly higher risk of overweight/obesity, asthma, diabetes, cardiovascular diseases, and some types of cancer compared to heterosexual people (Christian et al. 2021).

This inappropriate consideration of different user needs might be associated with the *design* process. Thus, homogeneous teams of technology developers can result in a narrow focus of purposes of mHealth technologies (Hendl et al. 2019, p. 83). For example, period and fertility trackers often "tend to reproduce male visions of women's health and wellbeing" (Sanders 2017, p. 53) and involve implicit assumptions about potential users that are driven by heteronormative and normalizing gender conceptions (Hendl et al. 2019, p. 84). Hence, this narrow focus risks neglecting the specific needs of groups who are not appropriately considered in the design and development process. This can manifest in a gender-stereotypical design of self-tracking applications, e.g., in the color design (Epstein et al. 2017), and the representation of gender-related concepts within the app. For example, Deborah Lupton (2014) found "that concepts of reproductive and sexual embodiment as they were represented in the apps were strongly gendered, supporting norms and assumptions about male and female sexual and reproductive bodies" (611–612; see also Ruckenstein and Schüll 2018). Hence, by reproducing and stabilizing the existing gender arrangements in their design, such technologies are occasionally even seen as a more powerful continuation of patriarchy (Sanders 2017, p. 49).

The *database* and the general approach of self-tracking devices might cause further inequalities because "[d]ata sets are not, and can never be, neutral and theory-free" (Crawford et al. 2014, p. 1668). Since the general approach of self-tracking refers to a quantified body that is compared to at least implicitly predefined norms, self-tracking technologies and the subsequent analyses of the data often contain certain pre-assumptions about heteronormative bodies that can be classified in normalizing grids. Consequently, the primarily descriptive data gains a normative dimension (Selke 2016). This underlines why "algorithmic power has the potential to make certain bodies more visible than other" (Mularoni 2021, p. 7). Like many design decisions that render women invisible (Perez 2019), self-tracking technologies also threaten to make non-male or non-binary people invisible and create challenges for those who do not conform to the "heterosexual white male phenotype" (Mularoni 2021, p. 7). This way, potentially biased algorithm-generated knowledge and incomplete or biased training data might reproduce social injustices and inequalities (Hendl et al. 2019, p. 88).

Finally, even if there are technologies that, in principle, can benefit all in an equal way with regard to access, design, and database, their *implementation* can nevertheless be detrimental for some groups. For example, this is especially true when this implementation assigns health responsibilities that some individuals can only partially adhere to because the necessary resources and capabilities have not been provided or the respective health literacy is missing (Hendl et al. 2019).

This brief overview highlights the need for detailed feminist analyses of self-tracking technologies (cf. also Dolezal and Oikkonen 2021). Feminist perspectives are not merely supplementary but are of fundamental ethical importance. They can help uncover specific gender-related inequalities and discriminations in healthcare that are not only morally wrong (Hädicke and Wiesemann 2021) but also have a practical effect on the healthcare outcomes of marginalized or discriminated groups, such as an increased susceptibility to disease (Casanova-Perez et al. 2021). Against this backdrop, we aim to contribute to a distinct queer-feminist perspective on self-tracking to underline the relevance and necessity of such analyses, to illustrate our investigation through an empirical assessment, and to identify theses for queer technologies in healthcare to be tested and elaborated in further research.

3 Methodologies: Queer bioethics to analyze digital technologies

A queer-feminist perspective critiques the cis- and heteronormative social order that constructs gender and sexual variance through hierarchical binaries. In this sense, the perspective attempts to challenge patriarchal dominance and gender- and sex-differentiated inequality and oppression, while promoting a non-fundamentalistic approach (Sudenkaarne 2021; Trott and Laufenberg 2023). Cis- and heteronormativity can marginalize individuals and contribute to social instability and violation of human rights, particularly for those deemed 'deviant' from this norm, i.e., LGBTQIA+ (Hark and Meißner 2018).

Queer bioethics critically questions the basis on which "certain socio-medicalized views on gender and sexuality are justified in medical ethics" (Sudenkaarne 2018, p. 117). It focuses on access to and handling the medical and healthcare system and the unique health needs of LGBTQIA+ people (Wahlert and Fiester 2014, 2012). From this perspective, it advocates for a special consideration of the health needs of LGBTQIA+ people and calls for a renegotiation of medical ethical theory and practice to support health and well-being (Sudenkaarne 2018). Inherently, this perspective also reflects on other categories of social differentiation that support power relations and are interwoven with sexuality and gender, such as class, race and ethnicity, ability, and age (Winker and Degele 2010).

As a methodological approach, queer bioethics seeks to reduce gender- and sexuality-related biases, both on a practical, clinical level as well as in theoretical and meta-bioethical analyses (Wahlert and Fiester 2014). It is to be used to identify gaps in healthcare provision and to raise awareness of issues such as microaggressions, positive and negative discrimination, stereotypes and overgeneralizations, paternalism, and the marginalization of non-normative bodies. Following this approach, it is essential to take the perspectives, histories, and feelings of LGBTQIA+ persons into account and to integrate knowledge from queer-sensitive research and queer organizations into moral-theoretical judgment within healthcare contexts. Through this lens, queer-feminist bioethics questions the applicability of traditional theories and principles. In biomedical ethics, the queer bioethics perspective could, for instance, complement the renowned bioethical principles of respect of autonomy, nonmaleficence, beneficence, and justice (Beauchamp and Childress 2009) when it comes to dealing with gender and sexuality in healthcare practice and legislation. To serve as a practical and theoretical inquiry, investigations of practical cases and the further development and verification of the moral-theoretical framework must happen reciprocally (Sudenkaarne 2018, p. 119).

In our queer-feminist analysis of self-tracking technologies in health care, we apply this methodology to examine how issues of access, data, design, and use/function (cf. also Sect. 2) reflect and reproduce gendered, racialized, and heteronormative structures. These categories are crucial components of self-tracking technologies and can highlight (dis)advantages and benefits or exclusions from the expected health outcome. We apply these categories as follows:

With category *access*, we interrogate the forms of subjectification promoted by the applications. The category asks which offers of identification are made, which subjects are addressed, and which are considered ‘normal’ or ‘deviant’; in this way, it examines which groups the technology is accessible to (Fitsch and Kämpf 2022).

Data asks which data is queried and aggregated and how it is processed. In this regard, it is relevant to what extent the aggregated data questions or reproduces logics of representation (Kämpf and Rogers 2018). This comprises, for example, the question of whether value judgments regarding gender or sex relationships or body types are implicitly or explicitly made with the queried data (Wahlert and Fiester 2014). Furthermore, a critical attitude towards datafication and data monitoring is essential. Datafication, i.e., the transformation of certain aspects of life into digital data useful for a specific purpose (Mayer-Schönberger and Cukier 2013), can lead to better health outcomes for LGBTQIA+ when queer perspectives are included and implemented in design and outcomes. The processing of lived experience also provides new gateways for various practices of economization, governance, and domination (Aradau and Blanke 2017). Crucially, patients who use digital health services are patients *and* users. Users who make their data available for an application enter a one-sided relationship of dependency with the data owners. This relationship of dependency is largely determined by the fact that the transfer of knowledge about health needs also makes it possible to monitor and control these needs. This knowledge-based power is also attractive for commercial purposes and economic business models. As a result, there is a risk that health promotion is sidelined in favor of profit maximization. Queering digital health technologies, therefore, requires a critical examination of practices of datafication and economization as well as forms of surveillance capitalism (Rubeis 2023).

The category *design* refers to the configuration and development of the user interface and the user experience. It asks whether the design treats non-queer and queer subjects equally, excludes or pathologizes non-normative bodies, and which experiences are valued, prioritized, or normatively hierarchized (Wahlert and Fiester 2014).

Use or function reflects on whether the technology accounts for gender and sexual variance and makes queer health information accessible. The category emphasizes the metaethical need to treat LGBTQIA+ health issues as equally important, as opposed to a cis- and heteronormative perspective, and to integrate these needs on a structural level in the healthcare system, e.g., by an adequate implementation of respective technologies.

The four categories of *access, design, data,* and *use/function* are especially suitable for identifying and evaluating ethical questions at the intersection of (self-tracking) technologies in medicine and healthcare, social categories, and the broader societal context. They can thus extend established approaches in medical ethics by spelling out particularly the social justice perspective and structural aspects on the one hand, and by considering the specific moral issues of self-tracking technologies in medicine and healthcare on the other. This comprises, for example, the extension and modification of the primarily clinical ethics-focused principlist approach by Beauchamp and Childress (2009) to consider technology-induced moral problems appropriately (Schicktanz and Schweda 2021) and the re-interpretation of the underlying principles under the lens of queer bioethics. In this course, these categories also take up the impulses of existing approaches for the ethical evaluation of technologies, such as the MEESTAR model that addresses concrete socio-technical arrangements (Manzeschke et al. 2013; Weber 2015; further frameworks and considerations are proposed, e.g., by Loh and Grote 2023; Ammicht Quinn et al. 2015; Schicktanz and Schweda 2021). However, as a complement, our approach focuses on social categories, power structures, and the broader societal context. It can thus be understood as critical medical ethics (Rubeis 2024).

4 Analysis: Disrupting healthcare—the ambivalent consequences of self-tracking technologies in healthcare

To demonstrate our framework's applicability and provide first empirical insights, we have chosen one self-tracking application from each of three pertinent application areas for a closer analysis (nutrition/fitness, reproductive health, mental health). In our selection, we followed the idea of a theoretical sampling for qualitative research. Thus, our sample must not be understood to be representative. Instead, it follows the idea to present three cases that appear particularly valuable for a queer-feminist analysis of self-tracking in healthcare because they can illustrate the breadth of self-tracking applications and practices and their consequences from a queer-feminist perspective. In this way, they can serve as a basis for developing theses on how to shape queer health technologies to be tested in further empirical research.

Even though our selection followed theoretical arguments, we considered number of users, reliability, and successful establishment of the company as well as governmental clearances (e.g., U.S. Food and Drug Administration (FDA) or Digitale Gesundheitsanwendungen (DiGa)) to increase the practical relevance of our analysis.

4.1 Nutrition and fitness: MyFitnessPal

Fitness and nutrition are primary application areas of self-tracking technologies. For our analysis, we have chosen MyFitnessPal. This app describes itself as an all-in-one app that allows nutrition, weight, and fitness tracking (ZTG 2020) and is, therefore, especially suitable for an exemplary analysis. Users can log nutrients and calories by entering or scanning food, relate them to exercise and movement activities, and pursue individually defined goals. The app is not referenced as a medicine product in Germany (ZTG 2020).

a) Access and target group MyFitnessPal offers a free basic version and a chargeable premium version, occasionally causing a financial barrier for some users. During the registration process (see ZTG 2020 for an overview), the question to "select which sex we should use to calculate your calorie needs" offers "male" and "female" as sole options (MyFitnessPal n.d.a). As a further explanation, the app refers to different metabolic equations for men and women and continues: "If your gender identity is not the same as your sex assigned at birth, and you have not started gender-affirming medications, select your sex assigned at birth, because it will most accurately reflect your metabolic rate. If you have started taking gender-affirming medications, first consult with your doctor what might be the best selection for you" (MyFitnessPal Help 2021). Thus, on the one hand, we can identify an awareness for thinking about sex and gender beyond the binary. On the other, the app nevertheless tries to assign male or female to every user, neglecting any intermediate stage regarding both sex hormones and gender identity. Furthermore, any deviation from the binary norm is understood as a medical case that must be addressed through the consultation of a doctor, constituting a medicalization of sex and gender (cf. Bell and Figert 2012; Eckhert 2016).

b) Design MyFitnessPal provides a mobile and a web-based application. The website lists several testimonials with a short statement and a photograph. From a queer-feminist perspective, it is striking that despite all the individuality that is emphasized regarding the goals of the users, many pictures on the website and in the app refer to stereotypical body images portraying hegemonic masculinity and femininity (MyFitnessPal n.d.b). Thus, queer subjects are not treated equally, even though one might not speak of a complete exclusion or pathologization of non-normative bodies. Furthermore, the focus is on young and middle-aged persons, even though we can observe a certain diversity here. This is also true for the goals that can be selected in the registration process and occasionally go beyond normalized body images, e.g., gaining weight.

c) Data The binary distinction in the metabolic equation for males and females seems to be an essential distinction relevant to the entire program. Even though an individual target weight and health goals can be set in the registration process, and age, height, weight, and regular daily activity are used to calculate the calory requirements, the advice on nutrition to reach these goals also refers to the subjacent sex distinction in the metabolic equation. This risks neglecting the plurality of bodies and nutrition also within the genders. It is, therefore, problematic not merely for those who struggle to follow the binary gender norms but for everybody who does not meet the normalizing standards of the app. Thus, even though MyFitnessPal refers to a comprehensive data bank of nutrition information—the app promises access to over 18 million global foods (MyFitnessPal n.d.b)—the specific advice should be viewed cautiously.

d) Use and function Besides the possibility of tracking data, the app also suggests sharing data and progress in social networks and participating in the MyFitnessPal community (Kahl 2020). If one searches the MyFitnessPal-Blog for ‘sex’ or ‘gender,’ the blog offers an entry titled “Fitness Fueling: Gender-Specific Nutrition Concerns” (Russel 2018). The author, among other things, argues for “more gender-dependent nutrition research” in this entry. However, the whole blog post focuses only on the male and female gender and also the demand for more research is still entangled with the idea of a binary gender system since the author criticizes that research regarding nutrition has primarily focused on males due to the hormonal fluctuations of the female cycle, neglecting genders beyond the binary and their needs. Once again, this exemplary blog post underlines the decisive role of a binary gender distinction in nutrition, even though the author considers other categories than gender to be more important in nutrition.

The app might be used in institutionalized healthcare, e.g., in health prevention and promotion, sports medicine (Evans 2017), follow-up treatments such as bariatric surgery (Mangieri et al. 2019), or as “a valuable support for nutrition management” (Stehr et al. 2020, p. 10). However, given the app’s pitfalls, its implementation must be carefully considered to avoid creating and reproducing gender-related health inequalities.

Thus, while already in the registering process of MyFitnessPal, the binary distinction between men and women is decisive, and other genders are understood as medicalized deviations, the app design regarding testimonials and goals is more diverse. However, the binary gender distinction has a strong influence on the database and, in this way, on the use and function of the app: one can assume that the more the user corresponds to a male or female gender norm, the more valuable the app is.

4.2 Reproductive health: Ava bracelet

The Ava bracelet is a fertility tracking wearable by the company Ava (AVA Sciences-FMTC LLC, Zürich, and FemTec Health Inc., Houston, Texas). The product comprises a bracelet designed to be worn on the arm during sleep, paired with a smartphone app. Ava measures physiological parameters such as skin temperature, movement, sleep stages, heart rate variability, pulse rate, breathing rate, and skin perfusion. Combined with the app, it enables users to track menstrual cycle phases, fertility, and pregnancy (Ava n.d.a). It is cleared by the U.S. Food and Drug Administration (FDA) and CE-certified. The following section analyzes the AVA bracelet by referring to the pertinent studies on the app, data from the website, social media, and the app itself.

a) Access and target group The Ava-App and its website content are tailored primarily to cis-women, describing Ava as an "innovative technology company advancing women's reproductive health" (Ava n.d.a). However, it is not specified what is understood by the category "woman" and whether it includes queer individuals such as transgender women. The themes and design of the Ava Bracelet do not suggest the inclusivity of queer people, who remain entirely unmentioned by Ava.

Moreover, only women without implanted electronic devices like pacemakers and with a menstrual cycle length of 24 to 35 days can use the bracelet. "Irregular cycles," "Polycystic Ovary Syndrome (PCOS)," "pregnancy complications," "menopause," and "Reproductive Endocrinology" are seen as subjects for "future research" (Ava n.d.b). It thus becomes evident that Ava disregards queer individuals and overlooks various deviations from what is perceived as the norm, including people with disabilities, despite previous emphasis on the importance of reproductive health for these individuals (e.g., UNFPA and WEI 2023).

Additionally, the limited access to the technology due to its high price and shipping options available only to selected countries highlights the need to consider further social categories such as class and race.[1] A rather low accessibility of the app becomes apparent, especially for individuals who do not meet the stereotypical norms and expectations associated with being a woman.

b) Design The design of the Ava Bracelet's website targets women, displaying a binary perspective and many stereotypes about heteronormative relationships. However, although Ava's products are suitable for only a limited group, as has been made clear, the website portrays diversity in terms of race and disability, which suggests diversity-washing.

The bracelet itself is uniformly pastel green-blue and cannot be modified at the time of analysis (April 2024). The app is designed in pastel purple, lending a subtly feminine aspect to the design of Ava products. Additionally, the product's name 'Ava' is female-associated.

It is unclear who is involved in the technology's design and development, making it difficult to assess the team's diversity. The company's advisory team maintains a gender balance with an equal number of women and men, though it operates within a binary framework (Ava n.d.a), while, at the time of the company's launch in 2014, the development team comprised three men and one woman (Ava n.d.c).

Ava's social media representation on platforms like Instagram, TikTok, Facebook, Twitter, and LinkedIn mainly focuses on women and men, with an emphasis on women, and, in this way, reveals a noticeable absence of queer representation. Thus, even though an increasing number of people discusses queer topics on platforms

---

[1] The product's distribution is restricted, offering shipping to only a few selected countries, notably excluding non-Western nations. Additionally, Ava's cost of 300 euros makes the app less affordable, placing it out of reach for many and limiting its accessibility.

such as Instagram and TikTok in recent years, along with the rising presence of queer accounts,[2] it is surprising that queerness is entirely absent from Ava's profiles.

c) Data Ava advertises that studies support its product, yet the participants of these studies are only described as "women" (Zhu et al. 2021; Goodale et al. 2019; Shilaih et al. 2018, 2017). This implies that queer individuals were not included in the studies or no one considered it relevant to analyze their data separately and account for it distinctly from other data. Consequently, there is a gender data gap (Perez 2019) concerning queer individuals.

Furthermore, in these studies, women undergoing hormone therapy were also excluded (Goodale et al. 2019), as well as those who "had problems wearing the bracelet, had difficulty understanding the study procedures, had any health-related issues potentially affecting their menstrual cycles, were taking any medication or other substances that could affect the menstrual cycles or any physiological parameters being studied, were working night shifts or frequently traveling between different time zones, had a sleeping disorder or slept less than 4 h per night, or were actively breastfeeding" (Zhu et al. 2021). We can, thus, observe a very narrow, homogeneous study group here.

Additionally, other scholars have already criticized the fact that the only scientific studies on Ava Bracelet involve Ava itself (which published and sponsored them) and, therefore, can be questioned regarding competing interests. Moreover, the accuracy of Ava technology under free-living conditions, particularly concerning heart rate measurements, is criticized (Nulty et al. 2022).

Concerning data security, the company Ava states to comply with the EU General Data Protection Regulation (GDPR) and Swiss data protection regulations in its products (Ava 2024).

d) Use and function Blog posts on the website, as well as content on Instagram and TikTok, serve to enlighten readers about fertility and health: "Their mission is to expand the body of knowledge around female health and to apply those learnings to create innovative products that improve women's lives" (Ava n.d.a). There are no search results for 'queer' in the blog posts; besides fertility, other essential aspects of reproductive health (e.g., puberty, hormonal balance) are not discussed in Ava's blog posts, and no information is provided on gender injustice. The content promotes heterosexual relationships, even offering advice on managing and discussing these relationships. Thus, in the category of use and function, the idea of cis-women in heteronormative relationships as prototypical users of this app—and thus the neglect of potential queer users—continues.

The content provided by Ava across its website and social media platforms is highly success-driven, where success, in Ava's terms, is defined as "getting pregnant" and "infertility" is considered "a big problem" (Ava n.d.d). Website and social media content is about the right timing, efficiency, success orientation, and the emphasis on purchasing, all of which resonate with business and capitalist logic and neglect

---

[2] For example, see the profiles @queer.de, @queermed_deutschland, @queer_body_positivity.

certain health aspects. For example, issues like miscarriages, grief, well-being, and sexual desire are only occasionally mentioned.

4.3 Mental health: Deprexis

LGBTQIA+ people are at higher risk of developing mental health problems (Chhabra and Kapadia 2023; Grant et al. 2014; Terra et al. 2022; Wilson and Cariola 2020). The reasons for this are manifold and include, e.g., stigma, discrimination, barriers to healthcare, unmet needs, non-diverse research (Chhabra and Kapadia 2023; Halbeisen et al. 2022). Mental health is deeply entangled with questions of inequality, privilege, and embodied differences, which makes it necessary "to understand how self-tracking of mental health and illness may invoke and reinscribe ideas of gendered, racialized, or class-associated differences, or cement problematic ideas of disembodied mind" (Dolezal and Oikkonen 2021, p. 7). In addition, queer people might experience different mental health needs, for example, during a transition (Austin and Goodman 2018). We chose the self-tracking app deprexis for our queer-feminist analysis. Deprexis is an interactive online-based application to support therapy for patients with depression and depressive moods who are at least 18 years old.

a) Access and target group In Germany, gaining access to deprexis requires a doctor's prescription or proof of diagnosis.[3] As a result, there are no costs for the individual user, which means relatively low-threshold access in terms of economic barriers. However, structural inequalities such as limited access to healthcare (and thus diagnosis) and lacking digital infrastructure might complicate access. The use of deprexis is recommended for women, men, and non-binary people diagnosed with schizophrenia (F20), acute transient psychotic disorder (F23), schizoaffective disorders (F25), bipolar affective disorder (F31), and other symptoms affecting mood (R45.8). A limit for use is suicidal risk. An analysis of the deprexis app use shows an increased dropout risk for those with male gender, lower educational level, and comorbid anxiety (Karyotaki et al. 2015). Apart from this, the role of gender in depression is left out, even though depression is also dependent on how a culture defines mental health and illness—especially in light of the ongoing discussion about the ICD-10 code F76.0 defining transsexuality.

b) Design The German website's design (Deprexis n.d.a) and video trailer for the app show animated persons predominantly read as female. Also in the blog (Deprexis n.d.b), only three out of eleven images depict male figures. However, one blog article titled "Men and depression" shows sensitivity for gender differences regarding mental health (Wilken n.d.). It tries to deconstruct gender stereotypes by stating: "The image of the 'strong, protective and successful man' was and is not

---

[3] Individuals covered by insurance can obtain deprexis even without a prescription from a doctor. If they submit evidence of the applicable medical condition to their health insurance provider, they can use the application as well. Germany is the first country worldwide to prescribe digital apps (Dahlhausen et al. 2021).

just a role model, but also a kind of imprisonment for adolescent men” (ibid.). In contrast, the US American website shows much more diversity by using photographs that include PoC and people who visibly do not conform to prevailing gender norms (Deprexis n.d.c).[4]

c) Data For mental health apps, privacy concerns are an urgent issue. Thus, mental health issues are still the basis for stigma and can also result from discrimination and stigmatization (Link et al. 2018). Looking at history, especially for queer people, mental health data have not always been used for their purpose and interest (Khan 2022). This applies especially to people whose gender does not correspond to the binary heterosexual norm. The operator of deprexis has confirmed that no personal data flows to a country without an adequacy decision, such as the USA, following the so-called ‘Schrems II’ ruling.

However, despite the app being recommended for non-binary people, the studies on the detection of deprexis were only carried out on cis-men and -women between the ages of 18 and 65 (Meyer et al. 2015; Twomey et al. 2020). The treatment effects of deprexis were tested mostly on women (Meyer et al. 2015). No queer person was included in the study or at least this was not reported.

d) Use and function Deprexis is used as a therapeutic tool. One of the key features is its self-tracking functionality. Deprexis allows users to monitor their mood, symptoms of depression, and overall well-being over time. By regularly entering data about their emotional state and mental health, users can gain insights into patterns or triggers of their depression. Using a scientifically validated questionnaire (PHQ 9), they can record and view the progression of their symptoms. An item from the PHQ-9 questionnaire, for example, includes the question about enjoyment or interest in activities, another one tracks the speed of speech. The deprexis mood check, which is designed to track both the presence of symptoms that may vary over time and the progression of these symptoms, provides a temporal overview of the individual’s mental health state. However, it is unclear if this personalized therapy approach considers social determinants of health.

5 Discussion: Queering technologies—towards shaping a diversity-sensitive healthcare system with technologies

Our analysis of three exemplary cases of self-tracking applications illustrates that binary gender distinctions remain a predominant feature of these apps, strongly

---

[4] This section presents the status of the website by the time of analysis (April 2024). However, before the article went to press (November 2024), the website was completely revised and changed (Deprexis 2024a). Now, the German website of deprexis offers a relatively gender-neutral design with few animated graphics. While the blog post cited above has been removed, the distributors show sensitivity to gender-specific differences regarding depression in the blog, now (Deprexis 2024b). For example, one post points to gender-specific differences in the manifestation of depression in men and women and names this as a reason for a less frequent diagnosis and treatment of depression for men. Here, the post also mentions gendered socialization. We can thus observe a development towards a higher degree of gender sensitivity.

impacting healthcare at different levels. Thus, in the applications examined, even though some efforts have been made to acknowledge gender diversity, we could observe comparatively little or no awareness of queer perspectives regarding access, design, data, and use/function and insofar minimal attention to the needs of queer people. Furthermore, the apps risk promoting heteronormative, binary, and cisgender-stereotyped perspectives and further norms, such as heteronormalized body images.

These findings must not be understood as a representative overview of the entire landscape of self-tracking applications. We cannot make any statements about the frequency or specific manifestation of these moral problems in other self-tracking applications. In our investigation of the cases, we aimed to underline the importance and necessity of a queer-feminist perspective for identifying relevant inequalities related to social categories, demonstrate our framework's applicability, and get first empirical insights.

Even though our insights are by no way representative, they provide useful starting points for a 'queering' of health applications to be tested and elaborated in further empirical research. Thus, we propose the framework as a stimulus for evaluating other applications. Queering technologies for social justice offers a promising opportunity to shape more diversity-sensitive technologies that is already discussed in different areas of technologies, e.g., with regard to robots (Weßel et al. 2023, 2022), machines (Poulsen et al. 2020), everyday technologies, and AI (Klipphahn-Karge et al. 2023). The general concept of queering technologies involves the deconstruction of normalizing conceptions of identity and the overcoming of stereotypical perceptions of users (Weßel et al. 2023). The concrete potential for queering self-tracking applications becomes more apparent when considering health apps designed specifically for queer people or those that explicitly address their health risks and needs (Krasniansky and Ren 2021). Although the tracking function is not the focus of these apps, it is possible to identify their ideas for a more diverse healthcare system regarding access, design, data, and implementation, and, in this way, to draw conclusions also for self-tracking technologies.

Regarding *access*, we could identify various barriers to using self-tracking apps, including language limitations, technical requirements, and costs in the download process. The binary gender distinction observed especially in the registration process of MyFitnessPal and the Ava bracelet's focus on cis-women and a normalizing approach to women's health (e.g., the exclusion of women with irregular cycles or PCOS) can represent barriers for equal access. In contrast, a core purpose of queer apps is better access to healthcare. Platforms like FOLX Health and Plume, for example, offer fundraising opportunities for people who cannot afford the services and treatments in the context of gender-affirming hormone therapies (FOLX Health 2024a).

Furthermore, queer apps aim to provide inclusive and diversity-sensitive support. By acknowledging and addressing the specific needs of queer individuals, these apps create a safer space for users to access services, information, resources, and support tailored to their demands. Core elements of such apps often include community building, networking, and mutual support, such as support groups (e.g., Plume Health 2024) or live chat forums for LGBTQIA+ people to share their experiences (e.g., Queercare, cf. Devpost 2024). There is often also the idea of empowerment. Some apps offer links to resources for LGBTQIA+ people to learn about their rights and how to better advocate for themselves (e.g., Queercare). These examples demonstrate how equal access to and through digital technologies in medicine and healthcare can be achieved. This does not merely mean that apps such as Ava, deprexis, and MyFitnessPal should continuously work on addressing the health needs of queer people; it also suggests, that incentives should be created for the development of queer self-tracking technologies to ensure that everybody has access to applications that meet their individual health needs.

Regarding *design*, our analysis revealed a regular use of heteronormative body images, gendered beauty ideals, and stereotypes. For example, the lack of attention to queer perspectives became apparent in concrete design decisions. In contrast, while there is more diversity in terms of gender, ethnicity, and body types in the design of queer apps, their design and advertising often also primarily address young and able-bodied people and, by this, neglect older people and those with disabilities. However, intersectional perspectives remind us that systems of discrimination are intersectionally interwoven, leading to multidimensional experiences of discrimination (Crenshaw 1989). Therefore, future self-tracking apps must account for various social categories and as well their entanglement.

Although there are apps specifically aimed at LGBTQIA+ people, some still reinforce binary gender systems. For example, in the app Clarity LGBT, users can only select “Female”, “Male”, or “Both” for gender identity, “Feminine”, “Masculine”, or “Non-binar” for gender expression, and “Women” or “Men” for sexual/romantic attraction. This leaves no options for people who fit neither male nor female and people who are asexual and/or aromantic or attracted to non-binary people (Clarity 2024). Thus, also allegedly ‘queer’ apps still have expandable potential to move further beyond the binary and to realize a more subversive design that promotes a queerer healthcare system. For the examined apps, a more careful consideration of queer persons and life plans in the testimonials of websites and blogs, as well as the adoption of non-stereotypical designs, could improve inclusivity. Furthermore, queering the concepts embedded within the apps, e.g., in using a queerer idea of sexuality and reproductive medicine in the Ava bracelet, could help realize subversive designs.

The studies and training *data* on which the analyzed apps are based suggest minimal or reluctant inclusion of queer people. Thus, MyFitnessPal provides a huge food databank but also refers to male or female metabolic equations as a starting point. Similarly, we could observe that the Ava bracelet and deprexis rely on relatively homogenous study groups, that limit the scope of their respective database. This lack of diversity can be partially explained by the general limited (medical) research on trans and gender-nonconforming people. However, due to their occasionally severe consequences for those affected, such data gaps regarding queer people are problematic.

Another critical aspect in the data category is privacy and data security. Thus, within queer communities, privacy concerns are an important issue, as the history of how queer people have been treated is vicissitudinous. Diagnoses, for example, have not always resulted in help but rather in stigmatization. For queer people to consent to digital health technologies, they must be assured that this will not be to their disadvantage. Therefore, data provision must be deliberately negotiated and always used for the benefit of those providing it.

There has been progress on the regulatory level regarding data protection and security in recent years, which is reflected in the respective declarations the apps examined to comply with these regulations. Also queer apps, such as FOLX Health, state that they are “SOC 2 compliant” and treat security and privacy as a top priority. Health information is typically encrypted; only authorized personnel can access the data, and FOLX Health provides a privacy policy (FOLX Health 2023a) and security page (FOLX Health 2023b) explaining how they use users’ information.

Such secure and inclusive databases as well as individualized and critical usage possibilities could represent further steps towards queering self-tracking technologies. To create such a database, also for the examined applications, further research is necessary that, on the one hand, allows for the participation of queer users (e.g., regarding Ava and deprexis), and, on the other, moves beyond the binary and applies more fluid approaches to underlying concepts such as non-binary metabolic equations (MyFitnessPal).

The present analysis has shown that the *use and function* of the examined apps are often intertwined with binary gender distinctions. For example, MyFitnessPal’s nutrient measurement system is intertwined with ideas of the binary gender system. In contrast, queer health apps are characterized by their focus on the specific health needs of the LGBTQIA+ community. Apps designed for queer people generally address areas such as mental health, reproductive health, family issues, and gender transition processes, with more health apps under development (Beare and Stone 2021; Skeen et al. 2021; Sun et al. 2020). However, these developments show that one key aspect that sets queer health apps apart is their focus on health issues important for queer people. FOLX Health (2024b), for example, emphasizes that “coming out, discovering one’s identity, or facing family rejection can be incredibly difficult” and offers support for these issues.

Queer apps also help bridge gaps by offering information on LGBTQIA+ competent healthcare providers, enabling users to find professionals who understand their unique health considerations. In the app Queercare, for example, “users can rate healthcare providers based on their quality of care and knowledge on LGBTQ health issues” (Devpost 2024). Although sexual and mental health are particularly relevant to queer persons, LGBTQIA+ people need support across all aspects of healthcare, not just in these specific areas. It is not just about exceptional cases or specific needs but about providing more equal and fair healthcare in all areas. A diversity-sensitive function determination and implementation can promote such healthcare. Expanding the scope of existing apps such as MyFitnessPal, Ava, and deprexis to consider queer needs more comprehensively and working on appropriate (digital) alternatives for such apps on a rather structural level could be first steps towards such a diversity-sensitive implementation of digital technologies.

This makes clear that the subversive potential of self-tracking technologies for a queerer healthcare system cannot be realized easily and without considering the specific sociocultural contexts. Thus, even if self-tracking applications are designed in a queer-sensitive way, this does not guarantee better healthcare. Queer apps alone are not enough for systematic change. The medical education, the healthcare system (including all relevant players such as insurances), and the people working in it must be trained accordingly to meet the needs of queer people. Technological development must be accompanied by equally open, non-discriminatory legislation and societies. These societies should not only use the technology to legitimize the status quo but as a starting point for societal progress.

6 Conclusion

In our analysis, we could show (1) both the relevance and necessity of a queer feminist perspective in identifying moral problems related to gender-based inequalities and (2) sketch first starting points for more queer-sensitive technologies that should be tested and elaborated in further research. Thus, our discussion against the backdrop of queer technologies highlights the potential for a queer-sensitive design of apps and the digital healthcare system. We want to emphasize the productive potential of self-tracking technologies in creating diversity-sensitive healthcare. Equal access to and through digital technologies, a subversive design, an inclusive database, individualized and critical usage modes, and a diversity-sensitive function determination and implementation might be first steps toward building a queerer healthcare system. Specialized apps already contribute to a more diverse healthcare system with equitable access also for the LGBTQIA+ community by acknowledging and accommodating their varied health requirements and concerns, providing tailored information, and fostering inclusivity.

Our queer-feminist analysis highlights the need for a greater integration of queer theories into the field of health apps and digital health. Complementing intersectional analyses, our specific focus on gender allowed us to deeply explore the 'queer potential' of these apps. We want to stress the need for longitudinal studies to assess the sustainability and evolution of these apps over time. In addition, more participatory empirical research is needed to capture users' experiences with these health apps comprehensively and to inform the development of digital health systems. If we harness the "subversive potential of digital self-tracking-devices" (Sanders 2017, p. 45), the queering of digital self-tracking applications can be a first significant step toward queering healthcare in general.

Acknowledgements We thank Lydia Rupp for helpful remarks on prior versions of the manuscript. We also thank Gesine Buurman, Emma Dierlamm and Nele Zydziak for preparing the manuscript for publication.

Funding Tabea Ott received funding from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation)—SFB 1483—Project-ID 442419336, EmpkinS.

Anna Puzio is a researcher at the University of Twente in the research programme Ethics of Socially Disruptive Technologies. This research programme is funded through the Gravitation programme of the Dutch Ministry of Education, Culture, and Science and the Netherlands Organization for Scientific Research (NWO grant number 024.004.031).

Funding Open Access funding enabled and organized by Projekt DEAL.

Conflict of interest N. Ellerich-Groppe, T. Ott, A. Puzio, S. Weigold and R. Müller declare that they have no competing interests.

References

Ajana, Btihaj. 2018. Introduction. In *Self-Tracking. Empirical and Philosophical Investigations*, ed. Btihaj Ajana, 1–10. Cham: Palgrave Macmillan.

Ammicht Quinn, Regina, Maria Beimborn, Selma Kadi, Nina Köberer, Mara Mühleck, Mone Spindler, and Kaja Tulatz. 2015. Alter, Technik, Ethik. Ein Fragen- und Kriterienkatalog. University Library Tübingen. https://doi.org/10.15496/publikation-8982

Aradau, Claudia, and Tobias Blanke. 2017. Governing Others: Anomaly and the Algorithmic Subject of Security. *European Journal of International Security* 3(1): 1–21. https://doi.org/10.1017/eis.2017.14

Austin, Ashley, and Revital Goodman. 2018. Perceptions of transition-related health and mental health services among transgender adults. *Journal of Gay & Lesbian Social Services* 30(1): 17–32. https://doi.org/10.1080/10538720.2017.1408515

Ava. 2024. AVA Privacy Policy.V3.5. https://www.avawomen.com/de_en/privacy. Accessed 10 April 2024.

Ava. n.d.a. Science—Technology. https://www.avawomen.com/de_en/science-technology. Accessed 15 January 2024.

Ava. n.d.b. Science—Research. https://www.avawomen.com/research#%5Bobject%20Object. Accessed 13 January 2024.

Ava. n.d.c. Milestones in Ava's history. https://www.avawomen.com/de_en/about. Accessed 15 January 2024.

Ava. n.d.d. Home. https://www.avawomen.com/gb_en. Accessed 14 January 2024.

Beare, Zachary, and Melissa Stone. 2021. By Queer People, For Queer People: FOLX, Plume, and the Promise of Queer UX. In *SIGDOC'21: Proceedings of the 39th ACM International Conference on Design of Communication*, 20–25. https://doi.org/10.1145/3472714.3473618

Beauchamp, Tom L., and James F. Childress. 2009. *Principles of Biomedical Ethics*. New York: Oxford University Press.

Bell, Susan E., and Anne E. Figert. 2012. Gender and the Medicalization of Healthcare. In *The Palgrave Handbook of Gender and Healthcare*, ed. Ellen Kuhlmann, and Ellen Annandale, 127–142. London: Palgrave Macmillan.

Casanova-Perez, Reggie, Calvin Apodaca, Emily Bascom, Deepthi Mohanraj, Cezanne Lane, Drishti Vidyarthi, Erin Beneteau, Janice Sabin, Wanda Pratt, Nadir Weibel, and Andrea L. Hartzler. 2021. Broken down by bias: Healthcare biases experienced by BIPOC and LGBTQ+ patients. In *AMIA Annual Symposium Proceedings*: 275–284.

Charitsis, Vassilis. 2019. Survival of the (Data) Fit: Self-Surveillance, Corporate Wellness, and the Platformization of Healthcare. *Surveillance & Society* 17: 139–144. https://doi.org/10.24908/ss.v17i1/2.12942

Chen, Chuanrui, Shichao Ding, and Joseph Wang. 2023. Digital health for aging populations. *Nat Med* 29: 1623–1630. https://doi.org/10.1038/s41591-023-02391-8

Chhabra, Bhavya, and Stuti Kapadia. 2023. Mental Health Policies in Queer Community: Are We Doing Enough? *Journal of Loss and Trauma* 28(2): 182–186. https://doi.org/10.1080/15325024.2022.2068266

Christian, Lisa M., Steve W. Cole, Thomas McDade, John E. Pachankis, Ethan Morgan, Anna M. Strahm, and Claire M. Kamp Dush. 2021. A biopsychosocial framework for understanding sexual and gender minority health: A call for action. *Neuroscience and Biobehavioral Reviews* 129: 107–116. https://doi.org/10.1016/j.neubiorev.2021.06.004

Clarity 2024. https://play.google.com/store/apps/details?id=com.clarity_app_21798&hl=en_US&pli=1. Accessed 15. April 2024.

Crawford, Kate, Mary L. Gray, and Kate Miltner. 2014. Critiquing Big Data: Politics, Ethics, Epistemology. *International Journal of Communication* 8: 1663–1672.

Crenshaw, Kimberlé. 1989. Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago Legal Forum* 1989(1): 139–67.

Dahlhausen, Florian, Maximillian Zinner, Linn Bieske, Jan P. Ehlers, Philip Boehme, and Leonard Fehring. 2021. Physicians' Attitudes Toward Prescribable mHealth Apps and Implications for Adoption in Germany: Mixed Methods Study. *Journal of Medical Internet Research—mHealth and uHealth* 9(11): e33012. https://doi.org/10.2196/33012

Deprexis. 2024a. https://de.deprexis.com/. Accessed 25 October 2024.

Deprexis. 2024b. "Stark und still?" Die Wahrheit über Depressionen bei Männern. https://de.deprexis.com/blog/post/Stark-und-still-Die-Wahrheit-ueber-Depressionen-bei-Maennern.html. Accessed 25 October 2024.

Deprexis. n.d.a. https://de.deprexis.com/. Accessed 10 April 2024.

Deprexis. n.d.b. https://de.deprexis.com/blog/. Accessed 10 April 2024.

Deprexis. n.d.c. https://us.deprexis.com/. Accessed 10 April 2024.

Devpost. 2024. https://devpost.com/software/queercare. Accessed 10 April 2024.

Dolezal, Luna, and Venla Oikkonen. 2021. Introduction: Self-Tracking, Embodied Differences, and Intersectionality. *Catalyst: Feminism, Theory, Technoscience* 6(1): 1–15. https://doi.org/10.28968/cftt.v7i1.35273

Eckhert, Erik. 2016. A Case for the Demedicalization of Queer Bodies. *Yale J Biol Med* 89(2): 239–246.

Ellerich-Groppe, Niklas. 2022. Zwischen neuer Solidarität und Entsolidarisierung – Der Sozialstaat angesichts des digitalen Wandels. *Zeitschrift für Politikwissenschaft* 32: 403–427. https://doi.org/10.1007/s41358-021-00300-4

Epstein, Daniel A., Nicole B. Lee, Jennifer H. Kang, Elena Agapie, Jessica Schroeder, Laura R. Pina, James Fogarty, Julie A. Kientz, and Sean A. Munson. 2017. Examining Menstrual Tracking to Inform the Design of Personal Informatics Tools. In *CHI'17: Proceedings of the SIGCHI conference on human factors in computing systems*: 6876–6888. https://doi.org/10.1145/3025453.3025635

Erdmann, Anke, Florian Schrinner, Christoph Rehmann-Sutter, Andre Franke, Ursula Seidler, Stefan Schreiber, and Claudia Bozzaro. 2023. Acceptability Criteria of Precision Medicine: Lessons From Patients' Experiences With the GUIDE-IBD Trial Regarding the Use of Mobile Health Technology. *Crohn's & Colitis 360* 5(4): 1–11. https://doi.org/10.1093/crocol/otad068

Evans, Daniel. 2017. MyFitnessPal. *British Journal of Sports Medicine* 51: 1101–1102. https://doi.org/10.1136/bjsports-2015-095538

Fitsch, Hannah, and Katrin M. Kämpf. 2022. Queerfeministische Perspektiven auf Subjekte im Digitalen. *Feministische Studien* 40: 218–26. https://doi.org/10.1515/fs-2022-0032

FOLX Health. 2023a. Privacy. https://www.folxhealth.com/legal/privacy. Accessed 15 March 2024.

FOLX Health. 2023b. Security. https://www.folxhealth.com/legal/security. Accessed 15 March 2024.

FOLX Health. 2024a. Care Fund. https://www.folxhealth.com/hrt-care-fund. Accessed 15 March 2024.

FOLX Health. 2024b. Mental Health. https://www.folxhealth.com/mental-health. Accessed 15 March 2024.

Frost, David M., and Ilan H. Meyer. 2023. Minority stress theory: Application, critique, and continued relevance. *Current Opinion in Psychology* 51: 101579. https://doi.org/10.1016/j.copsyc.2023.101579

Goodale, Brianna M., Mohaned Shilaih, Lisa Falco, Franziska Dammeier, Györgyi Hamvas, and Brigitte Leeners. 2019. Wearable Sensors Reveal Menses-Driven Changes in Physiology and Enable Prediction of the Fertile Window: Observational Study. *Journal of Medical Internet Research* 21(4): e13404. https://doi.org/10.2196/13404

Grant, Jon E., Brian L. Odlaug, Katherine Derbyshire, Liana R. N. Schreiber, Katherine Lust, and Gary Christenson. 2014. Mental Health and Clinical Correlates in Lesbian, Gay, Bisexual, and Queer Young Adults. *Journal of American College Health* 62(1): 75–78. https://doi.org/10.1080/07448481.2013.844697

Hädicke, Maximiliane, and Claudia Wiesemann. 2021. Was kann das Konzept der Diskriminierung für die Medizinethik leisten? – Eine Analyse. *Ethik in der Medizin* 33: 369–386. https://doi.org/10.1007/s00481-021-00631-4

Halbeisen, Georg, Gerrit Brandt, and Georgios Paslakis. 2022. A Plea for Diversity in Eating Disorders Research. *Frontiers in Psychiatry* 13: 820043. https://doi.org/10.3389/fpsyt.2022.820043

Hark, Sabine, and Hanna Meißner. 2018. Geschlechterverhältnisse und die (Un-)Möglichkeit geschlechtlicher Vielfalt. Bundeszentrale für politische Bildung. https://www.bpb.de/themen/gender-diversitaet/geschlechtliche-vielfalt-trans/245179/geschlechterverhaeltnisse-und-die-un-moeglichkeit-geschlechtlicher-vielfalt/. Accessed 16 February 2024.

Hendl, Tereza, Bianca Jansky, and Verina Wild. 2019. From Design to Data Handling. Why mHealth Needs a Feminist Perspective. In *Feminist Philosophy of Technology,* ed. Janina Loh and Mark Coeckelbergh, 77–103. Stuttgart: J.B. Metzler Verlag. https://doi.org/10.1007/978-3-476-04967-4_5

Hendl, Tereza, Bianca Jansky, Victoria Seeliger, Ayush Shukla, and Verina Wild. 2023. Ethical aspects of mHealth technologies: challenges and opportunities. In *Digital medicine: bringing digital solutions to medical practice*, ed. Ralf Huss, 101–128. New York: Jenny Stanford Publishing. https://doi.org/10.1201/9781003386070-7

Heyen, Nils B. 2020. From self-tracking to self-expertise: The production of self-related knowledge by doing personal science. *Public Understanding of Science* 29(2): 124–138. https://doi.org/10.1177/0963662519888757

Kahl, Kristin. 2020. Kalorienzähler – MyFitnessPal: Die eigene Ernährung im Blick behalten. *Deutsches Ärzteblatt* 117(11): A-554/B-480.

Kämpf, Katrin M., and Christina Rogers. 2018. Digital Cuts: Cutting flesh-technology-information-amalgams. transversal texts. http://eipcp.net/transversal/0318/kaempf-rogers/en. Accessed 16 February 2024.

Karyotaki, Eirini, Annet Kleiboer, Filip Smit, David T. Turner, Angel M. Pastor, Gerhard Andersson et al. 2015. Predictors of treatment dropout in self-guided web-based interventions for depression: an 'individual patient data' meta-analysis. *Psychological medicine* 45(13): 2717–2726. https://doi.org/10.1017/S0033291715000665

Khan, Farah N. 2022. A History of Transgender and Gender Diverse Health Care: From Medical Mistreatment to Gender-Affirmative Health Care. In *Transgender and Gender Diverse Health Care: The Fenway Guide*, ed. Alex S. Keuroghlian, Jennifer Potter, and Sari L. Reisner. New York: McGraw Hill.

Klipphahn-Karge, Michael, Ann-Kathrin Koster, and Sara Morais dos Santos Bruss. Ed. 2023. *Queere KI. Zum Coming-out smarter Maschinen*. Bielefeld: transcript.

Krasniansky, Adriana, and Jennifer Ren. 2021. Enabling more inclusive healthcare: Four market approaches to LGBTQ+ digital health. RockHealth. https://rockhealth.com/insights/enabling-more-inclusive-healthcare-four-market-approaches-to-lgbtq-digital-health/. Accessed 13 February 2024.

Link, Bruce G., Jo C. Phelan, and Greer Sullivan. 2018. Mental and Physical Health Consequences of the Stigma Associated with Mental Illnesses. In *The Oxford Handbook of Stigma, Discrimination, and Health*, ed. Brenda Major, John F. Dovidio, and Bruce G. Link, 521–540. New York: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190243470.013.26

Loh, Janina, and Thomas Grote. 2023. Einleitung: Medizin – Technik – Ethik. Spannungsfeld zwischen Theorie und Praxis. In *Medizin – Technik – Ethik. Spannungsfeld zwischen Theorie und Praxis*, ed. Janina Loh, and Thomas Grote, 1–14. Berlin: Metzler.

Lucivero, Federica, and Karin R. Jongsma. 2018. A mobile revolution for healthcare? Setting the agenda for bioethics. *Journal of Medical Ethics* 44(10): 685–689. https://doi.org/10.1136/medethics-2017-104741

Lupton, Deborah. 2014: Apps as Artefacts: Towards a Critical Perspective on Mobile Health and Medical Apps. *Societies* 4: 606–622. https://doi.org/10.3390/soc4040606

Mämecke, Thorben. 2016. Benchmarking the Self. Kompetitive Selbstvermessung im betrieblichen Gesundheitsmanagement. In *Leben nach Zahlen. Self-Tracking als Optimierungsprojekt*, ed. Stefanie Duttweiler, Robert Gugutzer, Jan-Hendrik Passoth, and Jörg Strübing, 103–122. Bielefeld: transcript.

Mämecke, Thorben. 2023. Self-Tracking Revisited. Entstehung, Entwicklung und Zukunft des Phänomens. In *Mensch-Maschine-Interaktion. Konzeptionelle, soziale und ethische Implikationen neuer Mensch-Technik-Verhältnisse*, ed. Orsolya Friedrich, Johanna Seifert, and Sebastian Schleidgen, 39–44. Paderborn: brill mentis.

Mangieri, Christopher W., Rebekah J. Johnson, Lori B. Sweeney, Yong U. Choi, and Joseph C. Wood. 2019. Mobile health applications enhance weight loss efficacy following bariatric surgery. *Obesity Research & Clinical Practice* 13(2): 176–179. https://doi.org/10.1016/j.orcp.2019.01.004

Manzeschke, Arne, Karsten Weber, Elisabeth Rother, and Heiner Fangerau. 2013. *Ethische Fragen im Bereich Altersgerechter Assistenzsysteme: Ergebnisse der Studie.* Ludwigsfelde: VDI/VDE Innovation + Technik.

Mayer-Schönberger, Viktor, and Kenneth Cukier. 2013. *Big Data: A Revolution that Will Transform How We Live, Work, and Think*. London: John Murray Publishers.

Meyer, Ilan H. 2003. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychological Bulletin* 129(5): 674–697. https://doi.org/10.1037/0033-2909.129.5.674

Meyer, Björn, Julia Bierbrodt, Johanna Schröder, Thomas Berger, Christopher G. Beevers, Mario Weiss, Gitta Jacob, Christina Späth, Gerhard Andersson, Wolfgang Lutz, Martin Hautzinger, Bernd Löwe, Matthias Rose, Fritz Hohagen, Franz Caspar, Wolfgang Greiner, Steffen Moritz, and Jan P. Klein. 2015. Effects of an Internet intervention (Deprexis) on severe depression symptoms: Randomized controlled trial. *Internet Interventions* 2(1): 48–59. https://doi.org/10.1016/j.invent.2014.12.003

Mularoni, Alessandra. 2021. Feminist Science Interventions in Self-Tracking Technology. *Catalyst: Feminism, Theory, Technoscience* 7(1): 1–21. https://doi.org/10.28968/cftt.v7i1.34062

MyFitnessPal Help. 2021. I identify as transgender, non-binary, or gender non-conforming. Which sex should I select? https://support.myfitnesspal.com/hc/en-us/articles/360059617352-I-identify-as-transgender-non-binary-or-gender-non-conforming-Which-sex-should-I-select? Accessed 16 February 2024.

MyFitnessPal. n.d.a. Please select which sex we should use to calculate your calorie needs. https://www.myfitnesspal.com/account/create/demographic-1. Accessed 10 April 2024.

MyFitnessPal. n.d.b. Website. https://www.myfitnesspal.com/en. Accessed 10 April 2024.

Nulty, Alison K., Elizabeth Chen, and Amanda L. Thompson. 2022. The Ava bracelet for collection of fertility and pregnancy data in free-living conditions: An exploratory validity and acceptability study. *Digital Health* 8. https://doi.org/10.1177/20552076221084461

Paldan, Katrin, Hanno Sauer, and Nils-Frederic Wagner. 2018. Promoting inequality? Self-monitoring applications and the problem of social justice. *AI & Society* 38: 2597–2607. https://doi.org/10.1007/s00146-018-0835-7

Perez, Caroline C. 2019. *Invisible Women*. New York: Vintage Publishing.

Plume Health. 2024. https://getplume.co/. Accessed 15 March 2024.

Poulsen, Adam, Eduard Fosch-Villaronga, and Roger Andre Søraa. 2020. Queering machines. *Nat Mach Intell* 2: 152. https://doi.org/10.1038/s42256-020-0157-6

Prainsack, Barbara. 2017. *Personalized Medicine: Empowered Patients in the 21st Century?* New York City: New York University Press.

Prainsack, Barbara. 2018. The "We" in the "Me": Solidarity and Health Care in the Era of Personalized Medicine. *Science, Technology, & Human Values* 43(1): 21–44. https://doi.org/10.1177/0162243917736139

Rubeis, Giovanni. 2023. Liquid Health. Medicine in the age of surveillance capitalism. *Social Science & Medicine* 322: 115810. https://doi.org/10.1016/j.socscimed.2023.115810

Rubeis, Giovanni. 2024. Grundzüge einer kritischen Medizinethik. *Ethik Med* 36: 117–132. https://doi.org/10.1007/s00481-024-00804-x

Ruckenstein, Minna, and Natasha Dow Schüll. 2018. The Datafication of Health. *Annual Review of Anthropology* 46: 261–78. https://doi.org/10.1146/annurev-anthro-102116-041244

Russel, Lori. 2018. Fitness Fueling: Gender-Specific Nutrition Concerns. MyFitnessPal Blog. https://blog.myfitnesspal.com/fitness-fueling-gender-specific-nutrition-concerns/. Accessed 25 October 2024.

Sanders, Rachel. 2017. Self-tracking in the Digital Era: Biopower, Patriarchy, and the New Biometric Body Projects. *Body & Society* 23(1): 36–63. https://doi.org/10.1177/1357034X16660366

Schicktanz, Silke, and Mark Schweda. 2021. Aging 4.0? Rethinking the ethical framing of technology-assisted eldercare. *HPLS* 43: 93. https://doi.org/10.1007/s40656-021-00447-x

Selke, Stefan. 2016. Quantified Self statt Hahnenkampf. Die neue Taxonomie des Sozialen. *Bundesgesundheitsblatt* 59: 963–969. https://doi.org/10.1007/s00103-016-2381-0

Sharon, Tamar. 2017. Self-Tracking for Health and the Quantified Self: Re-Articulating Autonomy, Solidarity, and Authenticity in an Age of Personalized Healthcare. *Philosophy & Technology* 30: 93–121. https://doi.org/10.1007/s13347-016-0215-5

Shilaih, Mohaned, Valérie de Clerck, Lisa Falco, Florian Kübler, and Brigitte Leeners. 2017. Pulse Rate Measurement During Sleep Using Wearable Sensors, and its Correlation with the Menstrual Cycle Phases, A Prospective Observational Study. *Scientific Reports* 7: 1294. https://doi.org/10.1038/s41598-017-01433-9

Shilaih, Mohaned, Brianna M. Goodale, Lisa Falco, Florian Kübler, Valerie De Clerck, and Brigitte Leeners. 2018. Modern fertility awareness methods: wrist wearables capture the changes in temperature associated with the menstrual cycle. *Bioscience Reports* 38(6). https://doi.org/10.1042/BSR20171279

Skeen, Simone J., Demetria Cain, Kristi E. Gamarel, Lisa Hightow-Weidman, and Cathy J. Reback. 2021. mHealth for transgender and gender-expansive youth: harnessing gender-affirmative cross-disciplinary innovations to advance HIV prevention and care interventions. *mHealth* 7: 37. https://doi.org/10.21037/mhealth-20-60

Stehr, Paula, Veronika Karnowski, and Constanze Rossmann. 2020. The multi-faceted usage patterns of nutrition apps: a survey on the appropriation of nutrition apps among German-speaking users of

MyFitnessPal. *BMC Medical Informatics and Decision Making* 20(1): 279. https://doi.org/10.1186/s12911-020-01294-9

Sudenkaarne, Tiia. 2018. Queering Bioethics: A Queer Bioethical Inventory of Surrogacy. *Journal of Ethics, Medicine and Public Health* 6: 117–125. https://doi.org/10.1016/j.jemep.2018.06.004

Sudenkaarne, Tiia. 2021. Queering bioethics: a queer feminist framework for vulnerability and principles. Dissertation. https://www.utupub.fi/handle/10024/152419. Accessed 25 October 2024.

Sun, Christina J., Kirsten M. Anderson, Tamara Kuhn, Liat Mayer, and Charles H. Klein. 2020. A Sexual Health Promotion App for Transgender Women (Trans Women Connected): Development and Usability Study. *Journal of Medical Internet Research – mHealth and uHealth* 8(5): e15888. https://doi.org/10.2196/15888

Terra, Tauana, Julia L. Schafer, Pedro M. Pan, Angelo Brandelli Costa, Arthur Caye, Ary Gadelha, Eurípedes C. Miguel, Rodrigo A. Bressan, Luis A. Rohde, and Giovanni A. Salum. 2022. Mental health conditions in Lesbian, Gay, Bisexual, Transgender, Queer and Asexual youth in Brazil: A call for action. *Journal of affective disorders* 298(A): 190–193. https://doi.org/10.1016/j.jad.2021.10.108

Trott, Ben, and Mike Laufenberg. 2023. Queer Studies: Genealogien, Normativitäten, Multidimensionalität. In *Queer Studies. Schlüsseltexte*, ed. Mike Laufenberg, and Ben Trott, 7–99. Berlin: Suhrkamp.

Twomey, Conal, Gary O’Reilly, Oliver Bültmann, and Björn Meyer. 2020. Effectiveness of a tailored, integrative Internet intervention (deprexis) for depression: Updated meta-analysis. *PloS One*. https://doi.org/10.1371/journal.pone.0228100

United National Population Fund (UNFPA) and Women Enabled International (WEI). 2023. Our Bodies, Our Rights! Addressing Sexual and Reproductive Health and Rights and Gender-based Violence for Women and Young People with Disabilities. https://www.unfpa.org/publications/our-bodies-our-rights-addressing-sexual-and-reproductive-health-and-rights-and-2. Accessed 13 January 2024.

Wahlert, Lance, and Autumn Fiester. 2012. Queer bioethics: why its time has come. *Bioethics* 26(1): ii–iv. https://doi.org/10.1111/j.1467-8519.2011.01957.x

Wahlert, Lance, and Autumn Fiester. 2014. Repaving the road of good intentions: LGBT health care and the queer bioethical lens. *Hastings Center Report* 44(S4): S56–65. https://doi.org/10.1002/hast.373

Weber, Karsten. 2015. MEESTAR: Ein Modell zur ethischen Evaluierung sozio-technischer Arrangements in der Pflege- und Gesundheitsversorgung. In *Technisierung des Alltags – Beitrag für ein gutes Leben?,* ed. Karsten Weber, Debora Frommeld, Arne Manzeschke, and Heiner Fangerau, 247–262. Stuttgart: Steiner.

Weßel, Merle, Niklas Ellerich-Groppe, Frauke Koppelin, and Mark Schweda. 2022. Gender and Age Stereotypes in Robotics for Eldercare: Ethical Implications of Stakeholder Perspectives from Technology Development, Industry, and Nursing. *Sci Eng Ethics* 28: 34. https://doi.org/10.1007/s11948-022-00394-1

Weßel, Merle, Niklas Ellerich-Groppe, and Mark Schweda. 2023. Gender Stereotyping of Robotic Systems in Eldercare: An Exploratory Analysis of Ethical Problems and Possible Solutions. *Int J of Soc Robotics* 15: 1963–1976. https://doi.org/10.1007/s12369-021-00854-x

Wilken, Moritz. n. d. Männer und Depressionen? Deprexis. https://de.deprexis.com/blog/patientengeschichte/maenner-und-depressionen-moritz-wilken/. Accessed 16 February 2024.

Willis, Henry A., and Enrique W. Neblett. 2023. Developing culturally-adapted mobile mental health interventions: a mixed methods approach. *mHealth* 9(1). https://doi.org/10.21037/mhealth-22-19

Wilson, Clare, and Laura A. Cariola. 2020. LGBTQI+ Youth and Mental Health: A Systematic Review of Qualitative Research. *Adolescent Research Review* 5: 187–211. https://doi.org/10.1007/s40894-019-00118-w

Winker, Gabriele, and Nina Degele. 2010. Frontmatter. In *Intersektionalität*, ed. Gabriele Winker, and Nina Degele, 1–4. Bielefeld: transcript Verlag.

Zhu, Tracy Y., Martina Rothenbühler, Györgyi Hamvas, Anja Hofmann, JoEllen Welter, Maike Kahr, Nina Kimmich, Mohaned Shilaih, and Brigitte Leeners. 2021. The Accuracy of Wrist Skin Temperature in Detecting Ovulation Compared to Basal Body Temperature: Prospective Comparative Diagnostic Accuracy Study. *Journal of Medical Internet Research* 23(6): e20710. https://doi.org/10.2196/20710

ZTG – Zentrum für Telematik und Telemedizin GmbH. 2020. Prüfunterlagen für die Applikation “Kalorienzähler – MyFitnessPal”. https://www.aerzteblatt.de/down.asp?id=25205. Accessed 16 February 2024.