QUALITATIVE HEALTH COMMUNICATION
VOLUME 1, ISSUE 2, 2022
ISSN: 2597-1417

Practices of self-tracking in infertility treatment: How bodily awareness is constituted

Matilde Lykkebo Petersen[1]

Martina Skrubbeltrang Mahnke[2]

Mikka Nielsen[3]

NAME OF DEPARTMENTS AND INSTITUTIONS:

[1] Department of Communication, University of Copenhagen, Denmark

[2] Department of Communication and Arts, Roskilde University, Denmark

[3] VIVE, The Danish Center for Social Science Research, Denmark

CORRESPONDING AUTHOR:

Matilde Lykkebo Petersen. E-mail: mlp@hum.ku.dk

QHC Qualitative Health Communication

ABSTRACT

Background: The femtech industry has grown extensively in recent years and in infertility treatment, the practice of digitally self-tracking menstrual cycles has become a popular way for patients to manage, monitor and deal with issues of fertility. **Aim:** The purpose of this study is to investigate how patients' self-tracking practices affect bodily awareness. **Methods:** The study draws on 20 qualitative interviews with 12 patients, recruited through a private clinic in Copenhagen, Denmark. Interviewees were selected based on the criteria: age, treatment type and length, and engagement in self-tracking practices. All interview material was thematically coded. **Findings:** The analysis results in three main themes: 1) self-tracking as a tool for knowledge creation and planning purposes, 2) self-tracking as body-awareness maximizing process, and 3) self-tracking as a professional and emotional process. **Discussion:** Through self-tracking practices, the menstrual cycle becomes a multiple object, interpreted and acted upon in diverse ways – all of which, however, aim to optimize conditions for conception. **Conclusions:** Self-tracking in infertility treatment affects bodily awareness in three distinctive ways: 1) it creates emotional ambivalence, 2) it places patients in an ambivalent position towards health professionals, and 3) it creates ambivalence towards patients' understanding of the menstrual cycle.

KEYWORDS

Awareness, bodily sensations, data, fertility, infertility treatment, self-tracking

BIOGRAPHIES

Matilde Lykkebo Petersen is a postdoctoral researcher at the Department of Communication at University of Copenhagen, where she is part of the HumanImpact research project that brings together humanities and businesses in collaboration. Matilde's research focuses on digital health communication, patient perspective, reproductive health technologies and bodily and somatic experience.

E-mail: mlp@hum.ku.dk. ORCID: 0000-0001-5745-7771.

Martina Skrubbeltrang Mahnke is an associate professor in Digital Humanities at Roskilde University, Denmark. Her research takes place at the crossroads of communication and digital technology studies and engages mainly in questions related to algorithms, data relations, artificial intelligence and user's experiences with digital technology.

E-mail: mahnke@ruc.dk. ORCID: 0000-0001-7034-1036.

Mikka Nielsen is a medical anthropologist, working at VIVE, The Danish Center for Social Science Research. Mikka is specialized in the phenomenology of mental illnesses, ageing, experiences of suffering, welfare technology, and doctor-patient communication.

E-mail: mikn@vive.dk. ORCID: 0000-0003-0754-2008.

Introduction

Many women engage in issues relating to their fertility at some point in life. To do so, digital applications are increasingly used. The so-called femtech industry comprising, amongst other things, mobile applications that track, monitor, and inform about a female's reproductive health, has grown immensely and has been predicted to have a market potential of US $50 billion in 2025 (Frost & Sullivan, 2018). More than 300 apps were already available in 2016, with an estimated download of 200 million worldwide (Eschler et al., 2019).

Historically, women have used various tracking methods to monitor their menstrual cycles, long before the advent of digital tracking technologies (Gambier-Ross et al., 2018). Self-tracking apps, however, not only help their users track personal cycles but also claim to promote the personal choices of their users, for example, actions related in order to potentially conceive or avoid pregnancy and to assess one's current bodily situation. A central feature of most fertility-tracking apps is fertility prediction; more specifically, the ability to predict the fertile window and, therewith, the days of ovulation. While fertility tracking as an everyday practice is driven by various motives and carried out in many ways (Epstein et al., 2017), the context of self-tracking during infertility treatment becomes ambiguous. On the one hand, it is a practice that most women in treatment continue as it has become integral to their everyday routines; on the other, it is a data practice that runs parallel to that of medical infertility treatment. Most patients gather diverse and substantial amounts of personal health data through self-tracking apps when trying to make sense of their (in)fertile bodies. Self-tracking in the context of infertility treatment becomes a complex, emotionally-loaded practice that plays a crucial role with regards to bodily awareness.

The aim of this study is to investigate how self-tracking practices affect infertility patients' bodily awareness both prior to and during treatment. The study considers self-tracking through menstrual cycle or fertility apps: apps that enable tracking of menstrual cycle patterns and related biological and mental symptoms. The apps vary in terms of how detailed the self-tracking practices they enable are and how they relate to infertility. Drawing on existing research in the field of self-tracking, critical discussions on how data practices constitute bodily awareness, and 20 in-depth interviews with patients in infertility treatment, this study aims to add a further dimension to self-tracking research, where self-tracking practices in the context of medical treatment is an as yet under-explored topic (Symul et al., 2019). We illustrate how women's bodily cycles become entangled with treatment protocols which, in turn, shape and are shaped by bodily cycles. Consequently, we argue that the menstrual cycle in infertility treatment becomes a multiple object (Mol, 2002), interpreted and acted upon in diverse ways by both patients and professionals. To ensure the best possible treatment for infertility patients, as well as a well-informed dialogue between patients and professionals, it is hence of significant importance for researchers and medical professionals to understand what is emotionally at stake when patients self-track and how this may affect their bodily awareness.

Literature review

Literature on self-tracking practices draws on a wide range of disciplines and keeps growing as self-tracking becomes an integrated practice in everyday life. Self-tracking practices are not new but have intensified through the wide availability of mobile phones and digital infrastructure (Neff & Nafus, 2016). Generally, self-tracking practices are related to the quantified self (QS) movement aimed at supporting personal development but recent studies have also highlighted more sensorial, emotional, and even resistance-oriented aspects of self-tracking (Sharon & Zandbergen, 2017). In the case of fertility, self-tracking practices are not just about the 'quantified (or quantifiable) information' in itself (Lupton, 2016, p. 27) but connected to the existential wish to become pregnant and have a baby. Current empirical studies mirror this by describing fertility tracking as goal-oriented, as emotionally loaded, and as datafied practices. These types of practice build the fundament of this study and will be elaborated below. In addition, we present a critical perspective on fertility self-tracking that highlights more general issues of personal health data practices.

Fertility tracking as a goal-oriented practice

Based on reviews of menstrual tracking apps, Epstein et al.'s study (2017) provides an overview of why and how women track their periods. The study finds that women track to: (1) be aware of how their body is doing, (2) understand their body's reactions to separate phases of their cycle, (3) be prepared, (4) become pregnant, and (5) inform conversations with healthcare providers. The study concludes that women find tracking helpful when discussing their health with healthcare providers and further emphasizes the dependency and importance of accuracy in the app predictions of ovulation and period. The authors criticize models that calculate fertility for (wrongly) assuming stability and regularity in women's menstrual cycles. These models also do not keep up with life changes during the life course such as menstruation in puberty, being sexually active, trying to become pregnant, being pregnant, post-partum and menopause, as well as other changes and/or illnesses (Epstein et al., 2017, p. 11).

Figueiredo et al. (2021) evaluated the 31 most used/reviewed fertility tracking apps. They conclude that apps currently offer support for goal-oriented use but that many users wish to use the apps in a more holistic way, supporting multiple goals at different life stages and transitions. Gambier-Ross et al. (2018) look specifically into the use of apps for fertility tracking. Through a mixed-methods approach consisting of a survey and follow-up interviews in the UK, the study finds that the main motivations for using fertility tracking apps are: 1) to observe one's cycle (72%), 2) to become pregnant (34%), 3) to inform infertility treatment (12%), and 4) to avoid pregnancy (4%) (Gambier-Ross et al., 2018, p. 5). According to the authors, fertility apps enable a greater understanding of women's relationship with their bodies through digitally-gathered data.

Fertility tracking as an emotionally-loaded practice

While most research on self-tracking focuses on the possibility of reflecting through and with data, only a few focus on the unintended emotional responses users may have. Figueiredo et al.'s research is unique in this sense as it explores fertility tracking with a focus on users' practices, sense-making, and related emotional struggles. The study investigates how women practice fertility tracking and share their results, as well as online meaning-making practices, with other users (Figueiredo et al., 2017). In sum, fertility tracking serves two purposes: 1) identification of the fertile window and thus the days of ovulation, as well as 2) the outcome: pregnant or not pregnant.

Continuing their study from 2017, Figueiredo et al. (2018) explore self-tracking related to fertility as emotionally complex and uncertain. In their study, they found five distinct types of emotional engagement with data: 1) positive, 2) burdened, 3) obsessive, 4) trapped, and 5) abandoning (Figueiredo et al., 2018). Most women have an optimistic attitude towards their fertility data; however, during the process of trying to conceive, some women express stress, anxiety and hopelessness, which may lead to obsessive engagement in self-tracking. Figueiredo et al. (2018) describe the most emotionally intensive relationship with self-tracking data as 'trapped engagement' (Figueiredo et al., 2018, p. 40:11). Here, women track extensively and long try to become pregnant in vain. These users feel they cannot stop tracking even though they want to, and the situation makes them feel depressed. Figueiredo et al. point out that getting 'good data' does not guarantee conception but that the interaction with data can make the difficulties of conceiving more visible, with the user feeling 'not normal' and an increased feeling of despair and failure (Figueiredo et al., 2018, p. 40:11).

Fertility tracking as a datafied practice

Self-tracking as a datafied practice points towards fertility apps offering specific normative frameworks. Consequently, users in infertility treatment and users with 'abnormal' cycles experience challenges and may feel excluded (Gambier-Ross et al., 2018, p. 13). In a systematic review of the use of menstrual and fertility app trackers, Earle et al. (2021) observe an increased use in digital health applications tracking and monitoring menstruation and fertility. The study points out that evidence-based research on the development and use of such apps is limited, that women value apps that are accurate and based on scientific evidence, and that they use fertility apps for different purposes that may change over time. The study thus contributes to the view that the specific datafication taking place when users interact with apps is part of a datafied practice whereby the app framework becomes critical to the user experience and tracking experience. Further, studies show, that apps' 'knowledge' of women's cycles is potentially gradually informed by usage and tracking practice – real-life experiences integrating into the app framework. Symul et al.'s (2019) quantitative study collected 2.7 million cycles recorded by 200,000 users from two major cycle tracking apps in the US and Europe. The study shows that the length of the average cycle is longer than the standardized 28 days and the ovulation period tends to span over more than days 14-15 (Symul et al., 2019, p. 4). Roemer et al.'s (2021) 10-year cohort study investigates how fertility-tracking algorithms adjust to changes in the individual menstrual cycle and under which conditions. The study concludes that algorithms do adjust to personal fertility statuses. In the

same vein, Sohda et al. (2017) evaluate how data obtained from self-tracking apps can be used to improve the accuracy of ovulation prediction. The study suggests that, even without integrating various biological metrics, the dataset collected by a self-tracking app can be used to develop formulae that predict ovulation, especially when data is aggregated.

Critical perspectives

In contrast to studies highlighting the improvements in and possibilities of digital health technologies, critical literature challenges the assumptions and structures underlying self-tracking apps as 'solutions' to a specific 'problem'. Lupton's (2015) critical analysis examines sexual and reproductive self-tracking apps through the lenses of 'participatory surveillance' and 'prosumption' (Lupton, 2015, p. 441). Lupton takes a critical stance towards the disciplining of the body through datafication, transforming bodies into numbers and performances, and finds that norms and gender stereotypes are reinforced through the apps, especially in relation to how women are held responsible for reproductive health (Lupton, 2015, p. 447). Hamper (2020) furthermore highlights the invisible labour that underlies self-tracking. Based on a UK interview study, Hamper (2020) argues that fertility apps are significantly involved in making fertility cycles known to users and thus configure the pre-pregnant reproductive body. The field of critical digital health studies (Lupton, 2014) is concerned with the ethical, social, cultural, and political implications of such applications. From a critical perspective, digital health applications are understood as sociocultural products that entail and enforce established norms and values and seldom support diverse sociocultural norms or even challenge the established status quo. Digital health applications are hence more than just 'instruments' that solve specific problems. Using such applications goes beyond the personal, leading towards broad societal and cultural implications, especially with regards to awareness of the body. To put it in Lupton's words: self-tracking devices 'confront' users to "make sense of the information, deciding how valid or valuable it is" (Lupton, 2018, p. 2) and translate human bodies into 'data repositories' that call users "to know their bodies better and more intensely" (Lupton, 2018, p. 2).

Methods

The following analysis is based on 20 qualitative interviews with 12 patients undergoing infertility treatment at a private clinic in Copenhagen, Denmark. The clinic is internationally recognized, has a strong reputation, and claims a high success rate. Different types of treatment are possible e.g., insemination, in vitro fertilization (IVF) and micro-insemination (ICSI), which is an advanced form of IVF treatment[1]. Eighty percent (80%) of the clinic's patients are international and travel for treatment to Denmark. The informants for this study were recruited via the clinic and reflect the client base of the clinic. The study received ethical approval through the home university in accordance with Danish law, the Regulation on data protection 2016/679. Informants were selected based on the criteria of age, treatment type and degree of engagement in self-tracking practices. Depending on where the patients were in the treatment process, the number of interviews varies between one and three and interview length between 25 and 60 minutes. The interviews evolved around the main

themes: how the patients experienced their treatment process, how they experienced their body in treatment and their (in)fertility, and how the patients used fertility self-tracking during the period of treatment.

The informants are between 26 and 45 years old. Ten of the women engage in self-tracking practices with apps, two of them were not tracking with an app at the moment of the interview. One of them was against tracking apps and had made a conscious decision not to use them. The fact that the majority of the group use apps to self-track (10/12) but that all of the women track mirrors the clinical staff's perception of the patients' tracking patterns. The women interviewed are international, with Nordic nationalities as well as European; one woman is Chinese. The informants' treatment processes vary, depending on personal health conditions. Some started with insemination, others are in IVF treatment.

All interviews were recorded, transcribed and anonymized. All interviews were conducted by the article's first author. The analysis follows the method of thematic coding based on a primarily data-driven principle, letting the empirical data guide the analysis (Kvale & Brinkman, 2009; Gibbs, 2007). During the analysis, we moved backwards and forwards through the material and related concepts that inspired and guided the coding process, in line with principles described in an abductive coding approach (Alvesson & Kärreman, 2007; Brinkmann, 2014).

Results

Three main analytical themes were identified: 1) self-tracking as a tool for knowledge creation and planning purposes, 2) self-tracking as a body-awareness maximizing process, and 3) self-tracking as a professional practice and emotional response.

Self-tracking as a tool for knowledge creation and planning purposes

The infertility patients in this study confirm prior research on women's motivations for using cycle tracker apps (see e.g., Gambier-Ross et al., 2018; Epstein et al. 2017). Knowing one's cycle is something most participants mention when being asked why they track their fertility. Jenny, 42, for example states: "So, I think [it is] very convenient to know myself. [...] by period calculation you more or less know, it's like output from yourself, you know your health condition. How the situation is." Jenny stresses that self-tracking is 'convenient' and a way to know the 'output from yourself'. Most of the interviewees mentioned that self-tracking gives them 'reassurance' and 'confidence in themselves'. Laila, 36, explains why self-tracking is particularly helpful during infertility treatment. She states: "It's really helpful to be tracking ahead of treatment definitely. So, you know your own body and what's happening." In Laila's words, self-tracking becomes a way of knowing 'what's happening'. Here, Laila's interactions with self-tracking apps form a frame in which to interpret her bodily reactions as 'real' and 'happening' because they are quantified and presented to her as specific forms of data in certain categories.

Another tracking motivation and practice relates to 'being prepared' and is about coordination and calendar planning. Natalie, 42, explains how her app use is for planning purposes and that her calendar revolves around her menstrual cycle. She elaborates: "Like work-related, seeing a friend, you know, planning a week and whatever. [...] it was funny because when you asked me when we could meet, the first thing I did, I checked my app." Natalie's example stresses how menstruation is the main concern guiding the patients in infertility treatment, as the whole treatment process revolves around synchronizing and optimizing the different steps of the menstrual cycle. Patients' everyday lives are planned around ultrasound scans leading up to egg retrieval, or when they must go to the clinic at a specific time for insemination. For international patients travelling for treatment to Denmark, in particular, coordinating their lives to fit with the treatment plan is a major task, and here self-tracking apps become all-consuming and, as Natalie mentions, fully integrated into everyday planning activities.

Self-tracking in infertility treatment relates not only to everyday activities but also to keeping track of the actual treatment process. Miranda, 45, explains how she uses self-tracking during her treatment:

> The main purpose has been to see like when does the next cycle start. And especially you know, when you have the 'too long waiting week', you know to wait and see if you're pregnant or not, it's nice to know when the period is supposed to be expected, […] that's how I used it the most, to predict when the period is happening, to see if I'm pregnant or not.

In Miranda's example, self-tracking is a crucial tool in the process to monitor signals and adjust her expectations, hopes and disappointment. In sum, it can be stated that patients undergoing infertility treatment use self-tracking for knowledge creation and planning purposes. This creates a focus on bodily signals, such as blood, mild pain, or swelling, which are recorded and documented through self-tracking apps. Ideally, this creates useful knowledge in relation to the patients' body and infertility treatment. Hamper (2020) describes this as a 'dual process of knowledge' (p. 14) where personalized knowledge about the user's individual cycle as well as general knowledge about reproduction and fertility issues is conducted. With regards to knowledge production and planning purposes, patients' overall experience of self-tracking is that it is helpful and purposeful; however, as prior research (Gambier-Ross et al., 2018; Epstein et al., 2017; Homewood et al., 2020) notes, it can also create experiences of uncertainty and discomfort, even feelings of not being normal, when apps do not allow patients to track themselves according to their own wishes.

Self-tracking as a body-awareness maximizing process

As described above, infertility patients gain general knowledge about the treatment as well as their own fertility issues through self-tracking apps. Consequently, attention is brought to their bodies. Margot, 40, self-tracks to make sense of her cycle and her bodily reactions to the hormonal treatment:

> Now on day sixteen-seventeen something like that and all the symptoms of ovulation are there, but the temperature is not going high, so I think the stimulation of last month is still making my cycle strange, because the ovulation days were around day ten to thirteen before […]. Just the cervical mucus is very fluid, very, very much more than usual. And the temperature stays low. […] So, it's interesting because it means that the hormone that was last month is still in my body and is still disturbing the cycle.

Margot's self-tracking practice reflects a detailed awareness of her cycle and bodily signals and suggests that the hormonal treatment has become part of an awareness-maximizing process. Another example is Annabel, 26, who began to self-track and thus became aware of her cycle in a new way:

> Before I started using it, I thought I had a rather short cycle. I felt like I was having my periods all the time, like you know every two weeks, BAM, it's again. And actually, I don't at all. It's just a really regular cycle. I didn't know that you had to start counting from the first day of your period.

By using her app, Annabel is not only becoming aware of her cycle in a new way, she is also reading her bodily experience in a new framework (experiencing her cycle short vs. regular).

In this regard, self-tracking becomes an awareness-maximizing process in which patients start to interpret and relate previously unnoticed bodily signals to fertility issues. Professional infertility treatment already demands much of patients when it comes to being bodily aware; however, self-tracking practices reinforce this bodily awareness. As much as the app is a handy tool to stay informed about bodily reactions and processes, self-tracking and having a constant focus on the body often results in practices that optimize the process through e.g., paying correct attention to the cycle. This may create the illusion that pregnancy can be achieved through correct tracking. Kira, 36, explains the process as follows:

> I haven't felt that I was able to hit exactly [ovulation]. I also did try to feel it in my own body. If it fit with the dates. And I think I experienced it once or twice, when it was THAT *(own emphasis)* day, and then it [the app] showed I was ovulating, but other than that it was difficult, I think […] so those things that prolonged my cycle also affected the app and gave me some not accurate or wrong dates […] I think it was November last year I really tried to, 'okay now we do it [have sex] that day', or now we do it two days in a row in those days, right? I've really tried to hit those, but where I just felt that, when I then had my period, where I just thought 'oh but why isn't it working?!' So it's been a bit frustrating, I think. And I've really been focused on those days, dates, the ovulation days, ovulation week, because you know, sperm can only survive in about five days.

In the unsuccessful process of trying to conceive naturally leading up to her starting infertility treatment, Kira describes how she reads her body signals and compares them with the tracked cycle. She awaits her cycle, awaits specific signals, and acts in accordance with the app's predictions, all to optimize the process. Kira's example is also an example of how patients try to increase their chances of pregnancy, and how this process is closely tied to quantifying bodily signals with the help of self-tracking. Many patients starting treatment are already 'savvy' trackers and very attentive to their cycle, as many patients have already been through a lengthy process of unsuccessfully trying to become pregnant.

Self-tracking as a professional practice and emotional response

Linked to body-awareness maximizing processes is a type of patient professionalization. By this we mean the experience patients have of becoming a project manager of their infertility treatment process, gaining specific knowledge and using it in the numerous tasks and appointments that make up the infertility treatment process. One aspect related to this is that patients, often on their own initiative, take on increased responsibility in their treatment process. They suggest, for example, the next steps in their treatment or pose questions about the route laid out by the doctor. Here, self-tracking plays a role in the patients' self-knowledge and how they perceive their situation and how to act on it. For example, Laila, 36, is actively

looking for clarification from her doctor based on her assessment of her self-tracked data and her treatment process:

> At the moment I'm not sure the cycle will be successful. So I think I'm just a bit apprehensive. I think I seem to ovulate really, really late, and I'm concerned that might be a problem. So I think if it gets cancelled, if I can't go ahead, then I'll try and meet with the doctor and talk about what we can do about that. Whether I can try medicines to ovulate earlier or whether it's maybe not a problem and I'm just thinking it's a problem. But I think, yes, sort of already a week ago, the clinic thought I would be ready, and so a week on I'm still not ready, and so I'm bit worried. That something's wrong.

Having tracked her menstrual cycle for so long and knowing her usual pattern and symptoms, Laila is assessing her cycle on hormonal treatment and is worried that her knowledge is not being considered in the treatment plan.

Other ways patients participate in the process or take on responsibility are through personal research, specifically googling fertility-related issues or going on special diets, doing specific exercise, or trying out new habits to deal with stress and feelings of worry. Even if most patients have faith in the clinic, the uncertainty about *when* they will become pregnant and conceive a child, or if they *ever* will, installs this ambivalence between a 'trusting passive patient' and a 'professionalized responsible patient', in which self-tracking practices are supportive of the latter strategy.

Furthermore, patients respond to this uncertainty by adopting self-tracking as an emotional response. Annabel, 26, states that self-tracking is "kind of reassuring" and Christel, 41, is happy for the reassurance self-tracking can give her:

> I also think it's nice to know, well, okay, it's right around now that I need to have my period, so you just have to check it, right? [...] I think it provides some kind of reassurance somehow. [...] So it was actually nice to be able to sit and show it [to the clinic].

Patients undergoing infertility treatment form a unique group in health care since the overall goal is not to avoid sickness or death but to conceive a child. Most of these patients are aiming to achieve a personal dream and much-desired wish, although sometimes they are also dealing with fertility-related challenges and illnesses. Figueiredo et al. (2018) pointed out that infertility treatment is typically intricately connected to patients' emotional life. This underlying premise is reflected when interviewing patients, especially when they are asked to describe their situation and treatment experiences. Since there is no guarantee that they will ever conceive a child, their treatment process is closely tied to emotions of expectation and disappointment, to potential joy, sorrow, and the overall experience that 'it is hard'. The image of an emotional roller coaster is echoed by many patients as well as staff and is a meaningful image because patients continuously go through a new cycle of hope, expectation, disappointment, and sorrow/frustration, with each menstrual cycle signifying another round of treatment which, for many, does not end in becoming pregnant. This may lead to a specific form of patient vulnerability whereby, the longer the treatment, the more emotions such as frustration and disappointment build up.

Self-tracking as an emotional response also provokes what has been described as an empowerment/failure schism (see Figueiredo et al., 2018; Hamper, 2020; De Moya & Pallud, 2017). This is the tendency for digital personal tools such as self-tracking apps to give the user a sense of empowerment precisely because they gain insight into and confidence in their own body. At the same time, users can experience a feeling of failure, as discussed by Hamper (2020), whereby some app users whose cycles are experienced as 'disorderly' and 'not

textbook', experience confusion and failure. Miranda, 45, is frustrated that self-tracking is not geared towards infertility treatment:

> Yeah! The cycles have been affected by the treatments. And I guess also I feel the treatments themselves have been very complicated because suddenly you're getting one injection every morning and then suddenly, you're having another one in the evening, and then if you take a tablet during the day then it will probably be nice to also have some sort of better form to track what to do then. Because sometimes I'm thinking, 'oh did I remember to take the one this morning or did I not', so I'm thinking I should probably have gotten like a box or something where you can fit in all the tablets to know that [laughs] I took it or not, you know?

These patients do not experience the expected (and promised) clarity and empowerment (Hamper, 2020, p. 22). In general, the emotional context of self-tracking is often seen as positive as it gives agency. However, engaging with self-tracked data also invokes negative feelings (Figueiredo et al., 2018, p. 13).

Discussion

The analysis shows that infertility patients' self-tracking practices are highly integrated in their daily lives and have become everyday routines. Self-tracking apps are used to create knowledge, and to know 'what is happening' in their bodies. In other words, self-tracking apps offer "semiotic cues that guide the user toward possible interpretations of the meaning in the data" (Lomborg et al., 2020, p. 4). They are also used for planning purposes and to keep track of the treatment process. The analysis shows that self-tracking reinforces the already strong attention placed on the body in infertility treatment. Infertility treatment demands a lot of discipline from patients with regards to bodily awareness, and self-tracking apps intensify this process. In response to these dynamics, infertility patients aim to develop a certain type of professionalism, which is connected to a hope that they will be able to manage the strong emotional reactions that follow treatment cycles. As infertility treatment is highly uncertain, patients further develop a variety of emotional strategies to deal with these issues. Not least, they create a strong relationship to self-tracking app data. Lupton (2018) has in this respect introduced the concept of data sense-making, which helps to grasp the human-data relationship. Looking into data practices of infertility patients shows that "people's responses to their personal data are always emplaced and embodied, building on their previous experiences and knowledges" (Lupton, 2018, p. 7). The co-constitution of data between the patient and self-tracking apps is thus as much a personalized gathering of data as an individual interpretation of the data produced. It is a meaning-making process of bodily sensations, signals and reactions bound to a highly systematized and datafied interpretation framework.

Self-tracking in infertility treatment is used to continuously monitor menstrual cycles. Users note specific dates in their apps, and they closely follow treatment tables from the clinic on when to inject hormones and when to expect the results of a pregnancy test. Data from the app sometimes corresponds with the doctors' expectations about ovulation time and sometimes it does not. Diverse kinds of data are used to predict the correct time for ovulation based on different logics inherent in the app and the treatment plan. Drawing on Mol (2002), this can be understood as the multiplicity of the female reproductive cycle. In her work, Mol (2002) demonstrates the multiplicity of bodies and how not only different medical fields' knowledge about bodies and diseases but also different enactments of and interactions with the object of treatment shape the multiplicity of the body. In the case of women's bodies in

infertility treatment, we see how ideas about the menstrual cycle and when ovulation time is measured sometimes clash or differ. The woman may know and interpret bodily symptoms of ovulation in one way, the app's algorithms may calculate the time of ovulation in another, and the doctors' plan, medicine and screening methods may predict a third time for ovulation. The menstrual cycle thus becomes a multiple object, interpreted and acted upon in diverse ways – all of which, however, are aimed at optimizing the conditions for conception.

What status is given, then, to ideas and practices related to the menstrual cycle in infertility treatment and how are they managed by the clinic? In Mol's analysis, the multiplicity of the body does not necessarily lead to fragmentation. The transfer of documents and conversations between doctors and patients ensures a kind of coherence despite the multiple actors and ideas involved. However, our study illustrates that a hierarchy of knowledge and practices are at play in infertility treatment. Once the woman starts treatment, bodily sensations as well as data from self-tracking apps are discarded in favour of the medically-controlled cycle. Nevertheless, most women continue to track their cycle, and a parallel monitoring of the cycle is maintained while also following the doctors' directions. Establishing a coherent notion of the cycle and a meaningful process of going through infertility treatment involves, we argue, acknowledging self-tracking practices and a conversation between doctor and patient about how these different ideas and practices are handled and potentially integrated into the treatment process. If the women's experiences and tracking practices are ignored, feelings of control (and lack thereof) and responsibility connected to these practices are equally ignored. It is therefore of significant importance that doctors are aware of, relate to, and take into consideration patients' self-tracking practices and the emotions and motivations they represent.

Conclusions

Self-tracking in infertility treatment is an ambiguous practice that affects women's bodily awareness in infertility treatment in three specific ways. Firstly, the practice of self-tracking creates an emotional ambivalence since, on the one hand, patients experience satisfaction and empowerment by producing their own data on their bodily processes during treatment. On the other, self-tracking practices may create frustration and overwhelming responsibility in patients when striving to optimize and control their body through self-tracking apps during infertility treatment. As current self-tracking apps are not geared towards infertility treatment, a second layer of data is created that does not necessarily correspond to the data produced during infertility treatment. For most women, this increases – if not maximizes – bodily awareness, which is already high to start with in the context of infertility treatment. For health professionals working in the field, it is important to acknowledge this emotional ambivalence in consultations so that women can find relief when emotionally burdened by this double layer of data.

Second, we argue that patients' self-tracking practices place them in an ambivalent position towards health professionals. To simply 'not track' is not an option for many women as it has become an everyday routine in infertility treatment, helping them to gather knowledge and generally know their bodies in relation to the menstrual cycle. Self-tracking is also used for planning purposes; it helps infertility patients focus and plan around possible fertile days. For many patients, the advantages of tracking outweigh the disadvantages. Lupton argues that

self-tracking technologies continuously empower the discourse that places trust in data over embodied knowledge. She writes: "Self-tracking devices are viewed as able to peer inside the body, releasing its secrets" (Lupton, 2016, p. 69). Numerical data was previously only accessible to health professionals but the advent of self-tracking technologies has opened up the possibility of any individual gaining access to detailed, systematized and quantified data representations of their body and health status. For many infertility patients, it is hence of great importance to track and thereby gain control over a process that is characterized by high uncertainty but this empowerment through quantified data additionally gives patients a new and unbalanced role in the consultation with health professionals.

Thirdly and lastly, we argue that self-tracking creates ambivalence towards patients' understanding of the menstrual cycle. As different types of data meet different forms of knowledge e.g., the medical vs. the self-tracking understanding, the menstrual cycle becomes a multiple object. Here, it is important for health professionals to acknowledge and challenge implicit knowledge hierarchies. Self-tracked data is typically accounted for in the first consultation but then it is disregarded in favour of the medical data collected. This may result in women feeling that the labour they have put into self-tracking is not valued. Here, it would be helpful to have a dialogue about patients' data practices and how data can be collected purposefully via available apps. In conclusion, it can be stated that research at the crossroads of medical and digital practices is fruitful. In particular, as the market for digital health products is growing, ever more patients will adopt some kind of digital health practice. It is hence of great importance that further research sheds light on the underlying practices and processes that guide and shape patients' understandings of their bodies and related health issues in relation to digital health applications.

Notes

1) IVF treatment involves taking hormone medication for 2 weeks on average to stimulate the ovaries to produce several mature eggs, which are then retrieved right before ovulation. The process sets the natural cycle on pause and can create temporary hormonal disturbances in the cycle after treatment. In the milder form of treatment, insemination, hormonal medication is often used to a minor degree to prepare the uterus lining for a pregnancy and to control the exact date of ovulation. It might not overtake the natural cycle but it is still a disturbing factor to the cycle.

References

Alvesson, M., & Kärreman, D. (2007). Constructing mystery: Empirical matters in theory development. *Academy of Management Review*, *32*(4), 1265–1281. https://doi.org/10.5465/amr.2007.26586822

Brinkmann, S. (2014). Doing without data. *Qualitative Inquiry*, *20*(6), 720–725. https://doi.org/10.1177/1077800414530254

De Moya, J.-F., & Pallud, J. (2017, June). *Quantified Self: A literature review based on the Funnel Paradigm*. [Conference paper]. *25th European Conference on Information Systems (ECIS)*, 1678–94. Guimarães, Portugal. https://www.researchgate.net/project/Comprehension-des-outils-de-mesure-de-soi

Earle, S., Marston, H. R., Hadley, R., & Banks, D. (2021). Use of Menstruation and Fertility App Trackers: A Scoping Review of the Evidence. *BMJ Sexual & Reproductive Health*, *47*(2), 90–101. https://doi.org/10.1136/bmjsrh-2019-200488

Epstein, D. A., Lee, N. B., Kang, J. H., Agapie, E., Schroeder, J., Pina, L. R., Fogarty, J., Kientz, J. A., & Munson, S. A. (2017, May*). Examining menstrual tracking to inform the design of personal informatics tools* [Conference paper]. SIGCHI conference on human factors in computing systems (CHI Conference), 6876–6888. Denver Colorado, USA. https://doi.org/10.1145/3025453.3025635

Eschler, J., Menking, A., Fox, S., & Backonja, U. (2019). Defining menstrual literacy with the aim of evaluating mobile menstrual tracking applications. *Computers, informatics, nursing*, *37*(12), 638–646. https://doi.org/10.1097/CIN.0000000000000559

Figueiredo, M. C., Caldeira, C., Eikey, E., Mazmanian, M., & Chen, Y. (2018). Engaging with health data: The interplay between self-tracking activities and emotions in fertility struggles. *Proceedings of the ACM on Human-Computer Interaction*, *2*(CSCW), 1–20. https://doi.org/10.1145/3274309

Figueiredo, M. C., Caldeira, C., Reynolds, T., Victory, S., Zheng, K., & Chen, Y. (2017). Self-tracking for fertility care: Collaborative support for a highly personalized problem. *Proceedings of the ACM on Human-Computer Interaction, 1*(CSCW), 1–21. https://doi.org/10.1145/3134671

Figueiredo, M. C., Huynh, T., Takei, A., Epstein, D. A., & Chen, Y. (2021). Goals, life events, and transitions: examining fertility apps for holistic health tracking. *JAMIA Open, 4*(1), ooab013. https://doi.org/10.1093/jamiaopen/ooab013

Frost & Sullivan (2018, January 31). *Femtech. Time for a digital revolution in the women's health market.* https://ww2.frost.com/frost-perspectives/femtechtime-digital-revolution-womens-health-market/z

Gambier-Ross, K.,, McLernon, D. J., & Morgan, H. M. (2018). A mixed methods exploratory study of women's relationships with and uses of fertility tracking apps. *Digital Health,* 4. https://doi.org/10.1177/2055207618785077

Gibbs, G. (2007). *Analyzing qualitative data.* Sage.

Hamper, J. (2020). 'Catching ovulation': Exploring women's use of fertility tracking apps as a reproductive technology. *Body & Society, 26*(3), 3–30. https://doi.org/10.1177/1357034X19898259

Homewood, S., Boer, L., & Vallgårda, A. (2020, April). *Designers in white coats: Deploying ovum, a fertility tracking device* [Conference paper]. 2020 CHI Conference on Human Factors in Computing Systems, 1–13. Honolulu, USA. https://doi.org/10.1145/3313831.3376528

Kvale, S., & Brinkmann, S. (2009). *InterViews: Learning the craft of qualitative research interviewing.* Sage.

Lupton, D. (2015). Quantified sex: A critical analysis of sexual and reproductive self-tracking using apps. *Culture, Health & Sexuality*, *17*(4), 440–53. http://dx.doi.org/10.1080/13691058.2014.920528

Lupton, D. (2014). Critical perspectives on digital health technologies. *Sociology compass*, *8*(12), 1344-1359. https://doi.org/10.1111/soc4.12226

Lupton, D. (2016). *The Quantified Self. A Sociology of Self-Tracking.* Polity Press.

Lupton, D. (2018). How do data come to matter? Living and becoming with personal data. *Big Data & Society*, *5*(2). https://doi.org/10.1177/2053951718786314

Mol, A. (2002). *The Body Multiple: Ontology in Medical Practice.* Duke University Press.

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

van de Roemer, N., Haile, L., & Koch, M. C. (2021). The performance of a fertility tracking device. *The European journal of contraception & reproductive health care*, *26*(2), 111–118. https://doi.org/10.1080/13625187.2021.1871599

Sharon, T., & Zandbergen, D. (2017). From data fetishism to quantifying selves: Self-tracking practices and the other values of data. *New Media & Society, 19*(11), 1695–1709. https://doi.org/10.1177/1461444816636090

Sohda, S., Suzuki, K., & Igari, I. (2017). Relationship between the menstrual cycle and timing of ovulation revealed by new protocols: Analysis of data from a self-tracking health app. *Journal of Medical Internet Research*, *19*(11), e391. https://doi.org/10.2196/jmir.7468

Symul, L., Wac, K., Hillard, P., & Salathé, M. (2019). Assessment of menstrual health status and evolution through mobile apps for fertility awareness. *NPJ digital medicine*, *2*, 64. https://doi.org/10.1038/s41746-019-0139-4

QUALITATIVE HEALTH COMMUNICATION

VOLUME 1, ISSUE 2, 2022