

Periods, technology and identity: The experience of period-tracking app users

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Abstract

Period-tracking applications (apps) allow users the ability to track their menstrual cycles and use algorithms which predict users future cycles. This study seeks to understand Irish users' experiences of, and reasons for, using period-tracking apps. In this qualitative study, a sample of 10 Irish women between 21 to 45 years of age were interviewed semi-structured and analysed using reflexive thematic analysis. This study identified their reasons for using these telehealth apps, discovered an over-reliance on apps by users, a desire for change and improvement of the apps, and identified a tendency of users to perceive their own bodies as faulty rather than question the accuracy of the applications. The study also discusses the implications of these findings and recommendations for the improvement of these apps for users.

Keywords

Femtech, telehealth, Identity, Women's health, Period tracking apps

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Introduction

The rise in popularity of period-tracking apps in the last decade has transformed the way menstruators measure and interact with their bodies forever. Female technology (Femtech) is a rapidly growing market (Shipp and Blasco, 2020). As their user base will likely expand, technological development has already had a significant impact on menstruators, and as the experience of menstruators is shaped by the social forces present in the design of these apps, it makes it worthwhile to study current users' experiences to discover if this technology is positive, safe, inclusive and the impact it may be having on users' self-identity (Gambier-Ross et al., 2018). The emergence of these apps has not been without controversy, as security and data privacy issues in Femtech are of growing concern. Previous literature has found certain period-tracking apps selling users' data to third-party companies and advertisers (Gilman, 2021). Due to Surveillance Capitalism, a form of capitalism reliant on collecting users' private data to be sold for profit, there has been a general increase in consumers concerned about data privacy (Zuboff, 2015). The research presents the opportunity to apply theoretical frameworks to an exploratory study on the use of apps within the Femtech industry. This article aims to address gaps in the current literature around period-tracking apps vis-a-vis Irish users' experiences of these apps. The main research question this study sought to answer is what are the experiences of people using period-tracking apps? To do so a qualitative approach was adopted with the aim to gain an in-depth understanding of users' experiences and perspectives through semi-structured interviews.

Literature review and theoretical framework

The new age of technology has ensured that apps have become key parts of our daily lives (Healy, 2021). The normalisation of the use of mobile apps to support and organise our daily life has extended to tracking menstrual cycles (Amelang, 2022). Digital health technology is becoming an increasingly important part of healthcare and health education (Lupton, 2015). Previous research around period-tracking apps and users' experiences has identified that period-tracking apps are part of the Femtech industry, focused on developing technology to help women maintain and improve their health (Gilman, 2021). The tracking of menstrual cycles is an ancient practice, but with the invention of Femtech, period-tracking apps began to rise in popularity among adult and adolescent women (Siapka and Biasin, 2021). A once-ignored overlooked area of healthcare is now being recognised as profitable, with \$82 million invested in 9 different Femtech companies in 2015 (Rosas, 2019). Gilman (2021) argues that while the industry markets itself with language about female autonomy and empowerment, they are part of a broader business model of data extraction for profit. Period trackers are one of the most rapidly growing developments within the healthcare application category (Levy, 2018). This category of apps had over 200 million downloads by 2022 (Broad et al., 2022). There are hundreds of different apps available to track menstrual cycles, with the most common type of period-tracking app being predictive where users input their data including information about their last period, and predictions for future cycles are then calculated

(Hohmann-Marriott, 2021). The apps not only function as digital calendars but they allow for the observation and interpretation of users' behavioural patterns associated with different phases of their menstrual cycles (Levy, 2018). These apps allow users to track mood swings, pain, sex life, use of contraceptives, and more (Levy, 2018). Delving into the patterns of one's menstrual cycle is a practice increasingly mediated by technology and is changing menstruators' ideas around health and wellness, in turn allowing them to be more in control and aware of themselves than ever before (Ford et al., 2021).

The literature tends to report similar reasonings behind the use of apps (Broad et al., 2022; Gambier-Ross et al., 2019; Levy and Romo-Avilés, 2019): planning and preparing for the next cycle and learning more about one's body, among the most common reasons cited. The literature also reports suggestions for improvements on the apps, including more accurate predictions, better design and higher quality information to be provided by the apps (Gambier-Ross et al., 2018). The ability to control, predict and prepare for menstruation may have an impact on users' sense of identity and actions and warrant the examination of possible sociological meaning behind why people use period-tracking apps and how this impacts them through theories of self-control and self-management.

The Internet is causing a transformation in human functioning, personhood, and identity. It offers novel means of social presentation and positioning, fresh avenues for expression, and innovative approaches to self-expression (Kirmayer et al., 2013). These new technologies encompass blogging and various social media platforms, and even apps, such as period-tracking apps, as well as the virtual spaces that constitute the realm of cyberspace. They introduce unique methods of accessing information, organising one's memory, and connecting with others. To the extent that these technologies alter our ways of experiencing ourselves, comprehending, and participating, we can discuss the emergence of novel forms of self and personhood (Kirmayer et al., 2013). As social media and digital tools become requirements for social participation, data mining becomes inevitable and intertwined with internet usage (Zuboff, 2015). Capitalism evolves to the needs of people in a certain time, humans have a mission to live effectively within our conditions of existence and the rationality of capitalism reflects this (Zuboff, 2019). Zuboff (2019) suggests there are three phases of modernity, in the first modernity, growth and the expression of self were repressed in favour of collectivism. In the second modernity the self is the only thing we have, our enhanced health and longer lifespans allowed for a more profound and mature personal life, reinforcing the validity of personal identity in contrast to established social norms and information, consumption, and travel which sparked individual self-awareness (Zuboff, 2019). The second modernity allowed Google into our lives enabling surveillance capitalism to form supported by this new kind of individual it created. The neoliberal vision has fostered an ideology of individuals sentenced to infinite competition for resources. Zuboff emphasises that the shift to a third modernity was summoned by the self-determining individuals, focused on 'my life, my way'. Zuboff (2019) argues that the third modernity and neoliberal policies have fostered an environment where private corporations, driven by profit motives, exploit individuals' data without their consent.

In the third modernity a new form of economic power emerged, whereby every casual search and click became valuable assets to be tracked, analysed, and monetised by companies. Over time, companies began to frame these intrusions as a necessary trade-off for 'free' internet services (Zuboff, 2019). Surveillance capitalism has commandeered the digital world to meet our needs for an effective productive life promising the magic of unlimited information and a thousand ways to anticipate our needs, as we see in Telehealth applications (Zuboff, 2019). Surveillance capitalists have assured their right to invade users' privacy at will. This is mainly accredited to Google's initial disregard for boundaries around private human experiences (Zuboff, 2015). Google developed the concept of behavioural surplus in 2001 and discovered that the more they capture and analyse user data, the higher the value of advertising (Zuboff, 2015). This led to historic profit for Google and the expansion of data analysis as a tool for predicting future user behaviour (Zuboff, 2015). These new practices by tech companies have challenged existing social norms regarding privacy and are contested as violations of privacy rights and laws. In response, Google and other companies have developed ways to obscure their operations to evade consequences (Zuboff, 2015). The lack of efficient laws nurtures these companies' invasiveness, additionally companies like Facebook have a generous lobbying budget used to push the boundaries of regulations and prevent new data privacy laws (Zuboff, 2019).

Under surveillance capitalism, individuals do not choose to have their data mined and behaviour tracked rather they do so because they are uninformed, and it is difficult to prevent (Zuboff, 2019). Similar to Karl Marx's analysis of capitalist political economy, surveillance capitalism further exacerbates the inequalities, exploitation and power imbalances in traditional capitalism. Surveillance capitalism's personal data harvesting does not stop at menstrual health apps, as it extends to all apps and websites online. The data collected by these apps for advertisers is highly personal and can expose nonconforming menstruators and record pregnancy termination which could endanger users (Hohmann-Marriott, 2021). Users are left in the dark about who knows what (how much of their personal information is shared and sold) and their rights to decide who knows (who gets to access this personal information) (Zuboff, 2019). Lawsuits into these violations of user's privacy are drawn out and lack consequences, additionally these companies occasionally alter their practices in response to weather backlash, although this usually consists of superficial adaptations to satisfying the demands of governments while also continuing to extract data (Zuboff, 2019). Surveillance capitalism cannot exist outside the digital environment, but neoliberal ideology and policy created the conditions for it to thrive. This ideology, along with its practical applications, subjects individuals in the second modernity to the harsh trade-offs inherent in surveillance capitalism's accumulation model, where information and connections are exchanged for the valuable behavioural data that drive its substantial growth and profits (Zuboff, 2019). Any attempts to dismantle surveillance capitalism must contend with this broader institutional framework that protects and supports its functioning (Zuboff, 2019).

Many argue that Foucault's concept of panopticism is the original idea from which surveillance capitalism derived. Foucault derived panopticism from his interpretation

of Jeremy Bentham's 'Panopticon'. The panopticon is a laboratory of power, it utilises observation and surveillance as a power tool (Foucault, 2008). The Panopticon is a prison whereby each individual is confined to a cell, the side walls of the cell prevent one from coming in contact with other prisoners, but all prisoners are observed by the supervisor. The panopticon reverses the principle of a dungeon to deprive a prisoner of light and be hidden, the cell is fully lit and in the eye of the supervisor, thus visibility becomes the trap (Foucault, 2008). Similarly, in surveillance capitalism the notion of 'free' services becomes a trap, if the app is 'free' the user's data becomes the product. The prisoner is seen but cannot see, solely an object of information, solely the product of data (Foucault, 2008). Surveillance capitalism thrives under the notion of individualism (Zuboff, 2019). The invisibility of the separated cells in the panopticon guarantees order and collectivism is abolished for a mass of separated individuals (Foucault, 2008). The panopticon is reflected in modern society whereby one is constantly observed (Wood, 2003), which in turn drives production, developing the economy and thus raising levels of public morality (Foucault, 2008). The panopticon induces a state of awareness and permanent visibility that assures the automatic functioning of power, whereby it is a machine that sustains power relations regardless of the operator, the inmates are themselves the bearers of the power situation (Foucault, 2008). The machine being the digital world in the context of surveillance capitalism, users of apps and websites assume responsibility for the constraints of power due to their visibility, they choose a user to play the power constraints unto themselves (Foucault, 2008). Surveillance capitalism acts as a 'Panopticon', where power is exercised subtly and pervasively, allowing individuals to be regulated without direct coercion. Instead of relying on overt rules and regulations, this form of power operates through the data mining of personal information, which is used to anticipate and influence consumer behaviour. According to Foucault (2008) and Youdell (2006), subjects are aware of their constant observation and learn to constitute themselves in certain ways – subjectivation – willingly turning oneself into what the 'observer' desires.

Foucault's theories of biopower explore how power techniques evolved as economics and politics became intertwined (Lazzarato, 2002). This shift led to surveillance reminiscent of the panopticon, where individuals and families are closely monitored by the state through management of their goods and wealth. Foucault discusses notions of techniques and practices of the self that imply how individuals constitute themselves in certain ways knowing they are being observed (Youdell, 2006). Foucault (1988) was interested in how individuals develop knowledge about themselves, he described four specific technologies that human beings use to understand themselves. They include technologies of production, permitting individuals to produce things; technologies of sign systems, permitting individuals to use signs, meanings or symbols, technologies of power, determining the conduct of individuals and subjecting them to domination, and technologies of the self (Foucault, 1988). The four types rarely function separately. We can perhaps consider technologies of production, in this case, app users' production of data about themselves, using charts, symptoms and calendars falling into the category of technologies of sign systems. Technologies of power is perhaps reflected in the surveillance capitalism pervasive in the apps making users and their data a commodity. Foucault

was fascinated by how, throughout history, people constituted their own subjectivity, this notion is entitled 'technologies of the self' which describes how individuals self-monitor and transform themselves to achieve happiness, perfection, and wisdom (Foucault, 1988). Derived from Greek philosophy and Christian asceticism, these practices emphasise self-care and self-knowledge through ongoing medical care (Foucault, 1988). Derived from Greek philosophy and Christian asceticism, these practices emphasise self-care and self-knowledge through ongoing medical care (Foucault, 1988). Modern femtech apps, where users track their menstrual cycles, exemplify this self-monitoring and align with the neo-liberal expectation of personal health management. Knowing oneself and taking care of oneself was the main principle for social and personal conduct in Greco-Roman philosophy (Foucault, 1988). Foucault also identified the techniques of the self in Stoicism; disclosure of self; examination of self and conscience, and as a theme in Plato's *Alcibiades*; the relation between taking care of oneself and knowing oneself (1988). According to Foucault (1988) permanent medical care is one of the central features of care for oneself, arguably period-tracking app users are pursuing this medical selfcare through the observation of their menstrual cycle, whereby the act of tracking their bodily functions is done by the self for the examination of oneself. Modern femtech apps, where users track their menstrual cycles, exemplify this self-monitoring and align with the neo-liberal expectation of personal health management. There are two differently positioned technologies of the self identified in the Hellenistic period of the early fourth century. The epistemological technology of the self traditionally emphasises the activity of self-disclosure in terms of 'an other', a more dialogic activity. The second is the ontological technology of the self, deciphering what the self already is (Martin, 1988). In the case of surveillance capitalism app users are self-disclosing unwillingly in terms of 'an other', the other being the surveillant and collector of their data, but consciously they are conducting ontological technology of the self, to decipher their health and body. Foucault's theories fluidly align concepts of surveillance, bio-power, self-monitoring, technology of the self, and medical care into an understanding of how power operates in modern capitalist societies. Surveillance from the state evolves into self-monitoring and biopower and 'technologies of the self' encourage individuals to self-regulate their health.

Friesen (2017) adapted Foucault's concept of the technology of the self to discuss self-externalisation in the digital age. Foucault wrote about the concept initially in 1984, defining it as a voluntary and reflective practice where one applies rules of conduct upon themselves, to transform themselves and make their life an oeuvre (a work of art) (Friesen, 2017). They constitute practices undertaken by a person directed to themselves, involving an externalisation of the self through confessional writing (Foucault, 1988). For Foucault (1988), confession serves as a means through which individuals engage with their truths and develop their identities. Traditionally linked to Christianity, a confessional religion, confession evolved into a broader social mechanism that encourages individuals to articulate their thoughts, feelings, and desires. Christianity requires each individual the duty of knowing who they are, to understand what is happening inside them and disclose it to God (Foucault, 1988). We can develop this confessional concept by linking it to modern digital media. Friesen (2017) argues that writing posts on social media becomes a technology of the self when one discusses their moods and posts

online 'confessions'. Friesen (2017) recognises that digital technologies are not entirely like Foucault's traditional technologies of the self, hence the use of social media builds on these practices that have been evolving over time. This argument can be extended to the concept of period-tracking apps, where users are prompted to input their moods, symptoms, diary entries, or create community posts, a type of confession allowing them self-reflection, to form a feeling of identity and self-externalisation. Users can track their emotions, bodily functions, and behaviours on these apps, which could give users a strong sense of self and allow them to feel in touch with their body. Foucault (1988) argues that confessions also operate as a form of surveillance, whereby individuals internalise societal expectations and norms, leading to self-regulation. Foucault (1988) stated that confession permits the 'master' to know because of his great wisdom allowing him to give better advice. In period-tracking apps the algorithm is the 'master' giving users advice and predictions.

Period-tracking apps are modern digital tools, yet they are deeply embedded in socio-cultural contexts with pre-existing meanings (Lupton, 2015). Websites discussing contraceptive issues, and sexual health education have existed since the creation of the internet, which have now evolved into apps that allow users to quantify their bodily functions digitally (Lupton, 2015). These technologies integrate self-surveillance into everyday life. The issue arises when users perceive data-driven insights from these apps as more reliable than their own subjective experiences and feelings about their bodies (Lupton, 2015). These apps impose on menstruators' a sense of self; by suggesting they allow app users to gain greater knowledge of their cycles than their own intuitive and personal knowledge of their bodies (Lupton, 2015). Hohmann-Marriott (2021) makes the argument that self-managing one's menstrual cycle adheres to neoliberal citizenship. This theory states that citizens, in this case menstruators, are responsible for their own lives including their bodies and their health, including the surveillance of their bodies, particularly reproductive bodies expected to fulfil their role of reproduction (Hohmann-Marriott, 2021). His theory extends to period-tracking apps by highlighting the expectation of digital citizenship, where individuals are expected to self-manage using available technologies (Hohmann-Marriott, 2021). Lupton (2015) suggests that the self-quantification promoted by these apps reflects a shift from state-directed healthcare to individual health management. Arguably this shift can give users a sense of control and autonomy, distancing them from reliance on state and healthcare services through self-tracking their menstrual cycles on apps.

Due to falling fertility rates, the increase in single-parent households, and the rise of alternative family structures like lesbian families, expectations surrounding motherhood are being questioned in modern Western society (Ulrich and Weatherall, 2000). Feminist discourse has criticised the notion that motherhood is a biological instinct for women, arguing that it undervalues women's contribution to reproduction and justifies the limits motherhood places on women's identities (Ulrich and Weatherall, 2000). However, there exists market-based assumptions about women's desire to have children. When the tech industry recognised that periods were profitable, they moved towards a surveillance paradigm, where women are tracked and followed across the web by advertisements with assumptions about their fertility (Gilman, 2021). Femtech promotes an

image of empowering women however at the same time, they push targeted advertisements about fertility onto users when not all menstruators are women, heterosexual, fertile or wish to have children (Tiffany, 2018). According to Gilman (2021), period-tracking apps' for-profit business models force women to perform invisible labour by selling their data to businesses with a predominance of men. The presumptions made about users by these apps and advertisements support the idea that most women want children, and this may be damaging to users, influencing their sense of gender identity. There is still a lack of research on the effects that period-tracking apps may have on users' gender identities, feelings about performing a certain gender, and gender expression.

As period tracking apps grow in popularity, this study seeks to understand the experience of the users while also understanding why they may choose to use these apps on a sociological level. The theories previously discussed inform this research and the interview questions and help us to contextualise why femtech users may be drawn to these technologies and how it may be impacting them. These theories address the roots, the cause of surveillance-driven technology, how it is profitable and productive, and why modern-day individuals feel compelled to use them and to self surveil. As previous studies have found preparing for their next cycle as a common reason for using the apps the theories of Foucault and subjectivation, panopticism and technologies of the self, can help us understand why users may feel drawn to self-management. These apps feed on this urge to oil the surveillance capitalism machine. Foucault's theories, especially biopower, align well with the theory of neo-liberal citizenship, all giving reasons why modern society encourages individuals to self-survey. The surveillance capitalist model of these apps paired with market-based assumptions around gender, womanhood and motherhood and the impact this may be having on users is an area lacking research. Hence this research seeks to investigate the experiences of menstrual app users through semi-structured interviews, informed by theories exposed above.

Methodology

To research the experience of Irish women as users of period tracking apps and the impact they may have on their identity, a qualitative approach was chosen to generate richer and more detailed answers and to put emphasis on the interviewees' own perspectives (Bryman, 2016). Semi structured interviews were utilised to discuss themes from prewritten interview guides crafted in order to address the research aims, while allowing the flexibility to ask new questions should alternative topics arise (Bryman, 2016). This format allows researchers to gain in-depth information from participants while considering the focus of the study (Ruslin et al., 2022). Qualitative interviewing is a highly popular approach for feminist researchers as it's said to support the principles of feminism (Bryman, 2016). A feminist research approach was intended in this study due to the nature of the themes, which focus on aspects of women's health, identity and gender inequality. Feminist researchers argue in favour of semi-structured interviews for their ability to allow women's voices to be heard through their own words. This method also allowed for rapport building and less hierarchical relationships throughout the

research process (Bryman, 2016). Ethical approval was gained from the ethics board from the authors educational institution. The first author was the main researcher who proposed the study, conducted field work, data analysis, and wrote up the dissertation as part of her final year project. The second author, who was the first author's supervisor, provided feedback on all aspects of the study design and write up of this manuscript. Participants were sourced via purposive and snowball sampling. To do so 4 people in the first author's network were provided participant information leaflets (PIL) to pass on to people they believed would be interested and suitable in taking part. Their referrals then connected the researcher to other participants. The sample consisted of 10 women with an age range of 21 to 45, all were of Irish origin except for one who was Polish and has been residing in Ireland for 15 years. Reflexive thematic analysis (RTA) was chosen as the method of analysis. RTA's flexibility allows for an inductive approach to coding, thus the codes and themes were driven by the content of the interviews themselves (Braun and Clarke, 2019). Additionally, this inductive approach allowed for the findings to give a voice to the users and it prioritised data-based meaning (Braun and Clarke, 2019). Following the coding process, and generation of themes, the data was then compiled to form the findings. Positionality theory acknowledges that interviewers and participants have multiple identities that can come into play and impact the research process (Bourke 2014). In the pursuit of rigour, researchers self-scrutinise and have an awareness of the relationship between themselves and the participant (SRA, 2021). The main researcher (first author) and her supervisor (second author) were both women. As a young woman is presumed to menstruate, the main researcher was perceived as an insider to the participants. This insider's perspective and the authors' own experiences and perspectives were considered during data collection, data analysis and write up through reflexivity, which required an acknowledgement of the authors' bias while keeping analysis grounded in the participants' data. Researchers are not disembodied entities rather we are differently positioned individuals in social structures (Bourke 2014).

Results

Interviews with participants focused on their experiences of using period-tracking apps, why and how they interacted with them. The following themes are a product of the qualitative interview questions and the reflexive thematic analysis conducted. All names are pseudonyms.

'I felt a little bit more in control': Apps as tools of prediction and self-management

Interviewees were asked why they used period-tracking apps and how they experienced the apps. Participants shared what information they did and did not input, and how they interacted with the apps, such as why they did or did not utilise extra features. The ability to predict the next period was the main function reported by interviewees as it allowed

them to feel in control of their cycles as the following quote by Katie illustrates: ‘So, I mainly used it to, or like started using it to track my cycle, just so I’d know, like they normally give you a warning like oh, your cycle will start in a few days’.

Entering the most basic information and not using extra features was also discussed. For example, Ciara noted ‘That’s really all (...) I do is [to] edit when it [my period] actually starts (...) That’s it, I don’t really put in the symptoms’. However, inputting extra information such as symptoms, and using the apps to help them track their fertility was also shared with the researcher. Aine’s quote illustrates this point ‘(I used the app) to figure out my ovulation when we were trying for a baby’. And she inputted extra information into the app post-pregnancy: ‘...but in between having a baby and getting my periods back, I was watching it [the app] and I was logging some symptoms to figure out whether I was coming back into menstruation again’.

A shared experience of app usage amongst interviewees was the sense of control and order it gave to them. Participants were able to learn more about their cycle which allowed them to feel more in control. Enya said: ‘Yeah, I think I felt a little bit more in control. I felt like I knew more about the rhythms of it because a lot of times I would say things like, oh, my periods are, like, irregular, or like, my periods are short. But I didn’t really know because I’d never systematically tracked it’.

Inputting data allows the apps to predict users’ next cycles which helps users to self-manage and plan life around their menstrual cycles. Sophie felt more connected to her body due to the app’s predictions: ‘I definitely think if I didn’t use it, I’d be more like clueless. I suppose it makes me more tuned in to my body because I have to input data into it to know the prediction of the pattern, like when it’s due’.

Interviewees saw value in using the apps as an educational tool. As Aine shared: ‘I’ve continued to use it (the app) because I felt it was informative’.

However, advice from the app was a feature users chose not to utilise due to their preference for simplicity. They were also sceptical of the sources and accuracy.

Enya was wary of trusting the app’s advice: ‘Yeah, but I think if you have interest beyond like very basic information, it was kind of... if you wanted to get more in depth, I wouldn’t have trusted the app per se because you didn’t know [from] where they were getting their information’.

Another attractive aspect of the apps was the visuals it provided and the clear quantification of the data that was inputted. Enya shared the satisfaction of seeing the length of her periods in the calendar format: ‘And it was also handy to see the length of it because mine would last probably, like, two to three days, and it would tell you that that would be on the shorter side. But again, it was nice to kind of see in a tangible way what was happening and be able to look back on it’.

The aforementioned features on the apps seemingly allowed users to learn more about their cycles in a clear manner, allowing them to feel more in tune with their bodies. However, interviewees had different views on the control which these apps provide to users.

Katie discussed: ‘I wouldn’t say it put me more in control, like my cycle was very regular, so if anything, it was just that it like notified me’.

The predictions provided, the clear visuals on the app, and the ability to plan around their cycles enabled users to feel more in control of their bodies and thus their lives. Each user tailored their use of the app elements to their own personal needs. Aspects of the app that interviewees distrusted or deemed unnecessary were ignored.

'I couldn't do it by myself': Dependence on apps and the faulty body

Interviewees shared their experiences of discovering previously unknown insights about their menstrual cycles through the app and, some interviewees discussed depending solely on these applications for health-related information.

I actually realised that my periods aren't normal. So, I wasn't like, I don't get every 20 days like everybody. I actually figured, oh, there was actually something wrong. But if I didn't use the app, I wouldn't have known. So that's why I find it really useful.

Additionally, interviewees stated they would find it too difficult to track otherwise. Charlene revealed: 'I've never managed my period, which is why I got the app, actually, because I couldn't do it by myself. (...) It's just an easier like, like, more structured, yeah, way to keep it all, the information, together'.

Participants described the notion of a 'normal' period being 28 days despite almost all participants sharing that their own periods did not fit this description. A repeated pattern emerged in which participants attributed the inaccuracies in predictions to their own bodies' shortcomings, rather than analyzing or critiquing the algorithm or the absence of inclusivity within the apps, for example, by providing a range of days in lieu of 28 exact days.

Ciara shared: 'So, say it would be accurate for someone that gets their period every 28 days. Sometimes mine could be every 40 days, I was recently diagnosed with that polycystic ovary thing. So, it's not, I don't get it every month. So that's why the app can be inaccurate at times. But it's not the apps' fault. It's just me'.

Aoife argued her period's irregularity would make it possible for apps to predict her cycle: 'It's never right for me. Well, that's because I'm so irregular. I don't know how it could ever be right for me because I just think so much affects when my dates are (of the period), that I don't even know if there's any form [of] artificial intelligence that could predict it'.

Interviewees also talked about how convenient it was to rely on the app to confirm their current menstrual phase when they encountered hormonal symptoms, instead of having trust in their own bodies and judgments. Enya discussed: 'If I say I feel like I'm PMSing [pre-menstrual-syndrome-ing], I can check the app and it will tell me if I am like four or five days out of my period or something'.

Sophie said: 'I don't have it on notifications so I just open it when I think it should be due, (...), or (feel) that it's going to arrive. Or like if I am feeling very hormonal like a week before I'll open it and check what date it's supposed to arrive on'. This trust in the apps contrasted with Keelin, who shared: 'But then there's also part of me that's like, oh, I don't know. Like I know my body more than they do, like what they're trying to tell me, kind of a thing...'

Interviewees shared that they depended on apps for menstrual cycle tracking because doing so manually felt too complicated. The app provided guidance on their emotional states and period symptoms. While the app was perceived as accurate and precise, the perception of their own cycles was as irregular and unpredictable.

'They are targeting women as just reproductive tools': Distrust and desire for change

Despite being users of period-tracking apps, participants expressed a certain degree of scepticism regarding the companies responsible for these apps and their intentions. They shared the belief that these apps prioritise profit and were not developed with the primary objective of empowering women.

Dara questioned: 'It's hard because you don't know what the app's motive is. Like is it actually genuinely to help? Or is it just another app to generate money and they are just doing it like it's just all to sell data?'

Participants believed that the producers of these apps did not truly care about user's experiences. Interviewees were concerned about the negative impact the apps could be having on users, and they reflected on negative experiences they themselves had.

Aine discussed her struggle regarding targeted ads and pop-up notifications.: '.... but I have noticed that it pops up every time to state "seven days to your next chance to get pregnant". And that sends notifications. When you have missed your period, "you could be pregnant". So, in that way, it's even though whatever they're sharing, the fact that they're sharing it back with me. And especially in my case, I wanted another baby and circumstances didn't allow it. It was horrible to receive that message every time I opened the app'.

The conversation about distrust in these apps extended to the observation that many of the apps primarily emphasised fertility. Certain participants believed that the presence of fertility and pregnancy-related advertisements imposed the concept of motherhood on those who menstruate. A common consensus emerged that these apps preoccupation with fertility and their promotion of targeted ads contributed to the notion that women's societal role is primarily centred around reproduction.

Aine stated: 'When you log into the app it immediately presumes you're trying to get pregnant and starts to ask you 'are you using contraception?'. Straight away starts to ask you, as I said I logged in and it said, 'six more chances to get pregnant this month' (....) So yes I do believe they target it (apps function) as reproductive (...) I do believe they are targeting women as just reproductive tools rather than (operating as) knowledge based applications'.

Following conversations about their experiences with these apps, the interviewees expressed their desire for specific improvements. Menstruators come from many walks of life and track their cycle for diverse reasons and applications should reflect this reality. They conveyed a need for app modifications that enable users to specify the purpose behind tracking their periods. This customisation would empower them to avoid receiving fertility-related information when it's not pertinent to their situation.

Aine suggested: 'They should have better user interfaces to state are you tracking your period for whatever and do you want to remove all relative information towards

pregnancy or towards babies, are you here to track it for mood, skin, hormone level, you know what are you trying to track it for?’

Interviewees believed changes can only be achieved through advocacy among users. Sophie stated: ‘I think that’s probably the only way to see change to advocate through the people who actually use the apps, because why would companies want to change if users didn’t want change. Users need to demand change for a company to want to change because if they didn’t change, they’d risk losing their customers’.

The apps caused interviewees to call their motivations into question. Interviewees did not view the apps as being genuinely concerned about women’s health or about enhancing users’ experiences. They held particular apprehension about the influence of targeted ads, which they perceived as perpetuating limiting gender roles. The desired changes from participants primarily centred around creating more user-friendly interfaces within the apps. They wished for the apps to prioritise and improve the user experience. However, users believed that the most effective means to bring about change was to pursue monetary actions against the companies through user advocacy. This underscores their scepticism regarding these apps as instruments of empowerment.

Discussion

Exploring the intricacies of the menstrual cycle has become more technology-driven, reshaping individuals’ perceptions of health and wellness. A key function of the apps for participants in this study was tracking their menstrual cycles and predicting their upcoming periods. This shift enables menstruators to achieve greater self-awareness and control than ever before. Participants shared how these predictions contributed to their sense of ease and control, aligning with prior research findings (Broad et al., 2022; Gambier-Ross et al., 2018; Levy and Romo-Avilés, 2019). This observation resonates with theories of neo-liberal citizenship, as users are focused on independently managing their bodies, a primary selling point behind using period-tracking apps. These apps empower users to take ‘medical responsibility’ for themselves, enabling them to monitor and gain insights about their bodies, a requirement for individuals as digital neo-liberal citizens (Hohmann-Marriott, 2021). Managing menstruation can be described as the manifestation of neoliberal citizenship within democratic societies shaped by neoliberal capitalism. While none of the participants explicitly mentioned feeling obligated to use these apps as menstruators, individuals are anticipated to demonstrate their citizenship by assuming personal responsibility for various aspects of their lives, including the management of their bodies (Hohmann-Marriott, 2021). The neo-liberal citizen theory does not necessitate self-management but rather implies an expectation for individuals to take charge of their health (Hohmann-Marriott, 2021). This assumption may reflect an implicit belief that they might subconsciously feel they should be using them.

Users expressed satisfaction in viewing their menstrual cycles presented on a calendar over time, a sentiment shared by previous users in the literature (Amelang, 2022). They valued the externalisation of self that these apps facilitated. Through the act of confessional recording, in this case documenting one’s menstrual cycle and associated symptoms in the app, users were rewarded with visual data. This quantification of bodily

functions through numbers and visuals can be seen as aligning with the concept of technologies of the self, as postulated by Foucault (1988). As argued by Friesen (2017), these apps empower users to self-manage their bodies, a notion supported by the interviewers' responses. The apps allowed users to discern what is and isn't typical for their own bodies and cycles, which in turn, enabled interviewees to gain self-knowledge and wisdom, which are central attributes of technologies of the self as conceptualised by Foucault in 1988.

The apps can also function as a form of medical record or diary, in what Foucault (1988) has identified as a confessional, and as a strategy of self-improvement. One interviewee, for instance, employed it to monitor the return of menstruation following pregnancy and to manage fertility. Interestingly, Foucault considered medical care as a central feature of taking care of oneself (Foucault, 1988). The app served an educational purpose for study participants. However, certain users harboured doubts about the app's information sources and perceived the provided information as overly generic. Leveraging Internet-based health resources holds significant promise for advancing mental health literacy, fostering self-care practices, and enhancing overall health and well-being (Kirmayer et al., 2013). A substantial portion of the content available on the Internet maintains a high standard of quality. Nevertheless, individuals without specialised knowledge may struggle to differentiate trustworthy information (Kirmayer et al., 2013).

When delving into users' experiences with these apps, a recurring theme emerged – the tendency to excessively depend on the app's accuracy and the inclination to attribute inaccuracies to their own bodies. Participants discussed how they gained a deeper understanding of their bodies and the menstrual cycle through app usage. Aligning with Foucault's exploration of the technology of the self as these 'confessions' emphasise the complex relationship between personal agency, identity formation, and the influence of the apps power in shaping how individuals understand themselves.

The fact that these women are self-educating themselves about their bodily functions hints at the concept that period-tracking is an aspect of being a neo-liberal citizen. It appears that women necessitated self-initiated education, and as digital neo-liberal citizens, they turn to technology for this purpose (Hohmann-Marriott, 2021). As an alternative, feminist health movements, such as 'Our Bodies Ourselves' advocate for a vibrant women's health movement, run by women for women, with the aim of educating women and fighting for health justice, consumer health and safety, and reproductive health rights, as opposed to relying on state education (Norsigian, 2019). However, the self-education facilitated by these apps aligns with the self-management characteristic of an ideal neo-liberal citizen.

Users reported reliance on the app to validate their emotional states. They mentioned their habit of turning to the app whenever they encountered potential hormonal side effects in order to confirm their current cycle phase, a trend observed in previous studies of app users and theorised by other researchers (Levy and Romo-Avilés, 2019; Lupton, 2015). Women often rely more on these apps than their own bodies, even in cases where they experience inaccurate predictions. The Internet reduces individuals' sensual engagement with the world to a few electronically mediated senses (Kirmayer et al., 2013). Curiously, users attributed this inaccuracy to their own bodies, believing that they do not conform to the standard 28-day cycle. Instead of critiquing the app's

accuracy, they tend to place blame on their own bodies. Femtech should ideally accommodate the diverse menstrual cycles of all users, ensuring that it does not lead to users developing negative perceptions about their own bodies. This underscores the need for these apps to be more inclusive, as they may not fulfil their claimed empowerment role if users find themselves frustrated for not fitting into the norm. This also extends to women who do not wish to become mothers, or perhaps cannot for medical reasons. Some participants held the view that the prevalence of fertility and pregnancy-related advertisements projected the idea of motherhood onto menstruating individuals. There was a widespread agreement that the apps' strong emphasis on fertility, along with the promotion of targeted ads, reinforced the perception that women's primary societal role revolves around reproduction.

More and more, the Internet is becoming intertwined with the tangible world, not just at the point where screens and keyboards meet. Additionally, this connection extends to social, and political ramifications. The real world continuously underpins the virtual world, both in the infrastructure that powers the web and in the genuine human interests and actions that shape it (Kirmayer et al., 2013). The Internet offers virtual realms that, in return, offer individuals a platform for their digital identity or identities (Dunn, 2013). Being present in these virtual worlds creates a space for individuals to showcase themselves, and engage in continuous identity communication, development, and exploration. The Internet provides a distinct arena where the self is not just presented but also forged (Dunn, 2013). Participants experienced a sense of pressure and discomfort due to the continuous emphasis on fertility. The app appeared to be putting pressure on participants' sense of 'female' identity.

Conclusion

The interviews captured users' experiences with period-tracking apps, and many of the findings parallel those of previous research. It became evident that users engaged with these apps primarily for the self-management of their bodies, predominantly utilising the app's basic features. Some users heavily depended on these apps for predicting their next menstrual cycle and felt incapable of tracking their periods without them. As reflected in Zuboff's (2019) discussion of a third modernity and self-determined individuals they used apps to take control of their information and health 'their way'. Interestingly, when the app provided incorrect predictions, users tended to attribute the fault to their own bodies, perceiving themselves as flawed rather than blaming the app. The way users interacted with these apps aligns with concepts such as neo-liberal citizenship, self-externalisation, and technologies of the self, proving to be valuable theories for understanding the experiences of women with these period tracking apps.

Furthermore, the additional features and functionalities of these apps exhibited characteristics of surveillance capitalism in their business models, offering a 'free' service in return for users' private information (Zuboff, 2019). Foucault's concept of panopticism describes a system where power operates through constant surveillance, encouraging individuals to self-regulate their behaviour to avoid scrutiny. Zuboff (2019) extends and elaborates on this idea, applying it to the digital age, where data collection has

become pervasive. Period-tracking apps are an example of this phenomenon, illustrating how we willingly transform ourselves into individuals who can be subjected, improved, and utilised by the mechanisms of power. Users recognised this power dynamic and viewed the apps as inaccurate and primarily profit-driven, expressing their desire for change. Surveillance capitalism thrives within a neoliberal framework that prioritises profit over privacy, making any attempts to dismantle it overly complex (Zuboff, 2019). However, users stated a desire for less targeted advertising and a reduced focus on fertility and pregnancy-related content within the apps, aligning with the feminist discourse discussed in the theoretical framework by Gilman (2021). Additionally, users voiced their frustration with the apps' lack of tailored advice and their desire for more accurate guidance, reinforcing the theory of these apps as tools of self-externalisation.

The Internet provides us with new media, new connectivity, and new terrain to explore (Kirmayer et al., 2013). Surveillance capitalism has commandeered the internet to allow us to meet our needs for an effective life (Zuboff, 2019). This is coupled with new modes of self-expression and participation afforded by specific types of social media, ranging from the instant correspondence of e-mail, the monologues of personal blogs, to the datafication of our bodily functions on period-tracking apps (Kirmayer et al., 2013). The issue is that our own awareness and self-understanding may be inadequate to comprehend and combat the consequences of this medium. There are the effects of technology we intend and others that come along unbidden, creating new problems and predicaments as well as possibilities (Kirmayer et al., 2013). The social sciences must work to understand and engage with how these new forms of technology are changing the meanings of knowledge production, identity and community. Foucault's concept of the "technology of the self" serves as a lens to understand the ways individuals shape and govern their own identities and behaviours through various practices. He argued that these technologies are strategies people use to create a certain self-identity, which involves self-reflection and techniques for self-improvement, allowing individuals to transform themselves in accordance with their ideals. We see this reflected in app users through the practice of confession that Friesen (2017) argues is enacted in digital technologies in contemporary society.

Although this article did address a gap in the existing body of literature, it is important to acknowledge its limitations. The sample size could have been increased to provide a more diverse representation of the Irish users' experience. For future research, it is recommended to conduct qualitative interviews with a more diverse sample. Regrettably, due to time constraints, this was not a feasible option in the present study. The contribution of this paper to the literature lies in capturing the experiences of actual users of period-tracking apps and discovering the changes they would like to see. The questions were open-ended and themes inductively driven by the interviews themselves reflecting the dynamic nature of qualitative research. By embracing both structured and unstructured elements, researchers can better understand and analyse the experience of users while keeping the focus on the topic under investigation. A future study that focuses specifically on 'giving a voice to users', may benefit more from an unstructured interview.

Users made many constructive criticisms of these apps, which are useful and informative for any producers of period-tracking applications, who should be willing to acknowledge and incorporate recommendations from users if they truly care about

empowerment, as many of them claim. Interviewees had criticisms regarding the interfaces of the apps in this study thus it would be recommended, based on app users' opinions, the following improvements:

- More inclusive and accurate advice around menstruation and cycle predictions, such as inclusivity of homosexuality when discussing the impact of sex on the menstrual cycle, acknowledging that not everyone is fertile or interested in childbearing and removing any specific mentions of menstruators as only women.
- More comprehensive education in primary and secondary schools about the menstrual cycle to enhance the critical capacity of users when engaging with apps.
- Additionally, all individuals should be taught to be more critical users of technology. We need to encourage women to be more confident and resilient users of technology.
- Apps should have interfaces that allow users to decline to receive information about fertility and pregnancy.
- Availability of apps that do not sell user data and push targeted advertisements.

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Author biographies

Blaithin O'Brien has obtained a first-class honour in Sociology and Social Policy from Trinity College Dublin. She is currently completing an internship with continued interest in research. She worked together with Edurne Garcia Iriarte at Trinity College Dublin.

Edurne Garcia Iriarte is an assistant professor, Director of Research, and Chair of the Research Ethics Committee in the School of Social Work and Social Policy, Trinity College Dublin (TCD). She joined TCD in 2009 as a Marie Curie Post-Doctoral Research fellow at the National Institute for Intellectual Disability. She graduated from the University of Salamanca (Spain) (BA in Psychology, 2001), and the University of Illinois at Chicago (USA) (MSc in Disability and Human Development, 2005, PhD in Disability Studies, 2009), where she also worked as a researcher and expert evaluator at the Centre for Capacity Building on Minorities with Disabilities Research (2005–2008). She has been on the Executive Editorial Board of the British Journal of Learning Disabilities since 2020 and, since 2009, she has been a university supporter of the Inclusive Research Network, a pioneer group of people with experience of intellectual disability conducting research in Ireland.

Appendix

Interview guide

Research question: What is the experience of people using period tracking apps and their awareness of data privacy risks?

Disclaimer: In this Interview, I am asking you about your use of these apps in relation to data privacy and your experience using the apps, not in order to record information about your personal menstruation or fertility.

Area 1: Why and how people use these applications

What age are you?

Do you use/or have you used a menstrual cycle tracking application?

What is your experience of using these applications?

How did you first hear about these apps?

Why do you use it?

What type of information do you enter?

Have you ever paid for a premium version or extra features? If so why?

Can you discuss if you feel more or less in control of your body or cycle thanks to using this app?

Do you feel like you should be using these apps?

Do you talk to other people about your use of these apps?

What do you talk about? Do u feel that it is a taboo?

Do the apps help with the taboo?

Area 2: Satisfaction with the application

What concerns do you have, if any, with your application of choice?

Has the app ever been wrong or inaccurate? How did that make you feel?

Do you feel it makes any assumptions about users based on its design?

Have you ever considered changing to a different app or deleting the app? Why?

What is your experience with the advice provided by the app?

How do you perceive the level of education about sexual and reproductive health provided by the app you use?

Can you give examples?

Has the app you used ever incentivised you to add additional information such as your mood or sexual practices?

Have you added this information? Why/why not?

Area 3: Knowledge of data privacy

What does online privacy mean for you?

Is it important to you?

What do you recall in relation to a privacy agreement or information about cookies when downloading the app and setting up an account?

What is your current knowledge regarding the privacy policy of the app you use?

What is your opinion on the clarity and readability of the apps privacy policy?

What is your knowledge about what is being done with the data collected on these apps?
For example, in relation to selling data to third parties?

As I was studying this topic, I came across some interesting information that I will share with you now:

An academic study revealed that most of these menstrual tracking apps earn profit by selling users data to advertisers. In this study, they found that the 10 most popular period tracking apps were selling data that included users gender, age, IP address, and user behaviour to big companies like Google and Amazon. Advertisers are particularly interested in identifying pregnant women so they can establish brand loyalty. (Source: Gilman, M.E., 2021. *Periods for profit and the rise of menstrual surveillance*. *Colum. J. Gender & L.*, 41, p.100.)

What concerns do you have, if any, about the information I just shared with you?

What concerns do you have about the idea of selling data from menstrual tracking apps to third parties?

Do you feel these apps are respecting the right to privacy regarding your sexual health?

What challenges do you believe could arise from data being sold by menstrual tracking apps?

Area 4: Knowledge of the abortion and sexual health policy landscape and safety

In 2018 the right to lawful abortion expanded and now allows for provision of abortions up to 9 weeks by GP'. Prior to this abortion was illegal in almost all circumstances. This change was made due to a referendum in May of 2018. (Mishtal, J., Reeves, K., Chakravarty, D., Grimes, L., Stifani, B., Chavkin, W., Duffy, D., Favier, M., Horgan, P., Murphy, M. and Lavelanet, A.F., 2022. Abortion policy implementation in Ireland: Lessons from the community model of care. *Plos one*, 17(5), p.e0264494.)

Did you use period tracking applications before abortion was legalised in Ireland?

If yes, what was your experience of using these apps in relation to the right to abortion?

Were you ever concerned about your data privacy and safety regarding menstrual tracking apps during this time?

In Ireland, we have the Right to Privacy meaning that all sexual and reproductive healthcare services should be confidential (*Ireland. (1945). Bunreacht na hÉireann = Constitution of Ireland. Dublin: Oifig an tSoláthai*)

What do you think about menstrual tracking apps in respect to these rights?

In June of 2022, the American Supreme Court overturned Roe vs Wade which guaranteed the right to abortion across America (McKenna, M. (2022) *Roe stood for 49 years. It revolutionized life for women*, *Wired*. Conde Nast. Available at: <https://www.wired.com/story/roe-overturned-supreme-court-dobbs-abortion-rights-revolutionized-life-for-women/> (Accessed: December 14, 2022).

Did you see any discussion or debate about the use of period tracking apps after this act was overturned?

Did this make you reflect about your own usage of these apps? What did you think?

Did this make you reflect on the privacy and safety of these apps? What did you think?

Area 5: Response to cases of data privacy violations

I am now going to inform you about a few more cases and studies I found surprising when I was doing my research surrounding these applications and data privacy concerns. I will present you these cases and you can look at them on the handout I will send to you after that interview, you can comment on each of them, or we can further discuss any case that may resonate with you.

One investigatory article found that period tracking apps OhMaya and MIA had been found to be sharing all inputted information with Facebook, among other third parties, this included users' diary entries, their mood, how often users had sex and whether or not protection was used. These apps are available in the EU.

Hence, not all apps are meeting GDPR obligations despite being available in EU app stores. GDPR is the EU General Data Protection Regulation which establishes by law data standards to protect EU citizens from data privacy abuses and establishes strong penalties for businesses that do not comply. (Greengard, S., 2018. Weighing the impact of GDPR. *Communications of the ACM*, 61(11), pp.16–18.)

Do you think this is cause for concern?

What is your experience of GDPR?

Would you feel comfortable using these applications?

Can you give me some examples as to why/ why not?

If the police have probable cause and issue a warrant on an individual, they can then access all the apps on that person's phone including health data. They may also request this data directly from medical tracking apps, which these apps are then obliged to provide them.

What concerns, if any, do you have about this?

The period-tracking app Clue currently partners with several universities, including Stanford and Oxford, sharing its data to promote menstrual health research.

What is your opinion on this?

Were you aware of this fact?

One study reported in an academic article found that period tracking apps' data is mined by third-party companies who then target motherhood or pregnancy advertisements to female users of apps who have been exposed and identified as either non-pregnant, pregnant, or approaching motherhood, without any other factors being taken into consideration.

What is your experience of getting targeted ads like these? Do you think these apps are really neutral?

What are your thoughts on the argument that targeted advertisements perpetuate the societal beliefs that a woman's role in society is expected to include reproduction?

What are your reflections on these cases and your own use of tracking apps?

Do they make you rethink your privacy and safety on these apps?

Would you like to see any improvements made regarding these apps and data privacy?

Would you recommend these apps to a hypothetical younger sister who just started her period?

Would you consider advocating to tech companies, such as Google and Meta, to demand better individual privacy protections?

For example, through petitions or protests?

Do you think that would be a productive or effective way to see change?

Would u pay for an app, so you'd know your data is safe?

Do you have anything else to say about your experience with menstrual tracking apps that I have not asked you about?