

THE CONTRIBUTION OF DATA TO FEMINIST TRANSFORMATION OF WOMEN'S RIGHTS TO HEALTH¹

EL APORTE DE LOS DATOS A LA TRANSFORMACIÓN FEMINISTA DE LOS DERECHOS A LA SALUD DE LAS MUJERES

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Abstract

Digital technologies and data science have evolved rapidly. But how does the digital evolution affect women's rights? Bunch argued that, to implement women's rights, it was first necessary to observe how they are violated (Bunch, 1990). This article examines how femtec's apps work, delivering reproductive and sexual health services to millions of women. Specifically, it analyzes the data collection permissions of 45 femtech apps to assess what the platform intends to do with the personal data collected and its objectives. To understand how these apps use data, we explored the goals of these apps in data collection and whether data could be collected and used to transform women's health. Thus, this work is structured in four sections. First, a theoretical review of Bunch's proposal and

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its contribution to data feminism is raised. Second, the potential for feminist transformation of human rights using digital technologies is discussed, particularly in women's health. The third section details the current use of health data captured by health apps. This article ends by drawing the main conclusions of the analysis and providing recommendations for a feminist transformation of data activism from a human rights perspective.

Keywords: Women's right to health; femtech; data gathering; platforms.

Resumen

Las tecnologías digitales y la ciencia de datos han evolucionado vertiginosamente. Pero, ¿cómo afecta dicha evolución a los derechos de las mujeres? Bunch argumentó que, para implementar los derechos de las mujeres, primero era necesario observar cómo estos se violan (Bunch, 1990). Este artículo examina cómo funcionan las aplicaciones de *femtech*, que ofrecen servicios en salud reproductiva y sexual a millones de mujeres. Concretamente, analiza los permisos de recogida de datos de 45 apps de *femtech* para evaluar qué pretende hacer la plataforma con los datos personales recogidos y cuáles son sus objetivos. Para entender el uso de los datos que hacen estas aplicaciones, exploramos los objetivos de estas aplicaciones en la recolección de datos y si se podría recolectar y utilizar datos para transformar la salud de las mujeres. Así, este trabajo se estructura en cuatro secciones. En primer lugar, se presenta una revisión teórica de la propuesta de Bunch y su contribución al feminismo de datos. En segundo lugar, se analiza el potencial de la transformación feminista de los derechos humanos utilizando tecnologías digitales, particularmente en el área de la salud de las mujeres. La tercera sección detalla el uso actual de los datos de salud capturados por las apps de salud. Este artículo termina sacando las principales conclusiones del análisis y proporcionando recomendaciones para una transformación feminista del activismo de datos desde un enfoque de derechos humanos.

Palabras clave: Derecho de las mujeres a la salud; *femtech*; recolección de datos; plataformas.

1. INTRODUCTION

There is no doubt that scientific progress and the development of digital technologies such as big data or Artificial Intelligence (AI) have played an essential role in the evolution of society, culture, and law. However, traditional approaches from International Law have been characterized by suspicions about the potential impact of the use of these technologies on 1)

the protection of privacy, 2) the protection of human dignity, and 3) the protection against social inequalities and environmental consequences of using technology (López Belloso, 2021). Nevertheless, these concerns have not included the impact that the biases of these technological advances have on the equality of men and women and the protection of women's human rights. Besides the field of economic and social development, from which technological advances have been perceived as potential tools for promoting development², these advances delved into the differences and gaps that the use of technologies entails for women, vulnerable groups, and developing countries.

This lack of attention to the impact of digital technologies on women's rights connects with a trend noted by Charlotte Bunch in Human Rights Law (1990): the failure to include the gender dimension in discussions about human rights. As this author points out, violations of women's rights have often been pushed to the side, either because other issues are judged more urgent or because the violations of women's rights are considered to be produced by individuals or private agents and not by states (Bunch, 1990, p. 488). Bunch distinguished four approaches to linking human rights with women's rights. With this perspective, this article explores the potential feminist transformation of the right to health that could be fostered by the use of digital technologies such as *femtech* (e.g., technological tools, products, services, or devices to address women's health issues, like menstrual or reproductive health).

The Beijing Declaration and its Platform for Action, adopted at the Fourth World Conference on Women in 1995, called for women's empowerment by improving their skills, knowledge, access, and digital technologies (United Nations, 1995). Over the last years, we have witnessed a growing expansion of the so-called *femtech*, a range of health software and tech-enabled products that cater to female biological needs.

2. See for example Resolutions: A/RES/58/200 from 23 December 2003; A/RES/59/220 from 22 December 2004; A/RES/60/205 from 22 December 2005; A/RES/61/207; A/RES/62/201 from 19 December 2007; A/RES/64/212 from 21 December 2009, A/RES/66/211 from 22 December 2011; A/RES/68/220 from 20 December 2013; and A/RES/ 70/213 from 22 December 2015.

This article argues that this sector of the technology industry could have the potential to drive a feminist transformation of women's right to health. Still, the gender gap that dominates the technology and medical sector prevents this transformation. To this end, this paper has used a mixed research methodology, combining desk research with the analysis of 45 *femtech* applications to determine the field's potential to transform women's right to health from a feminist perspective and assess the threats that technology and technological approaches may entail.

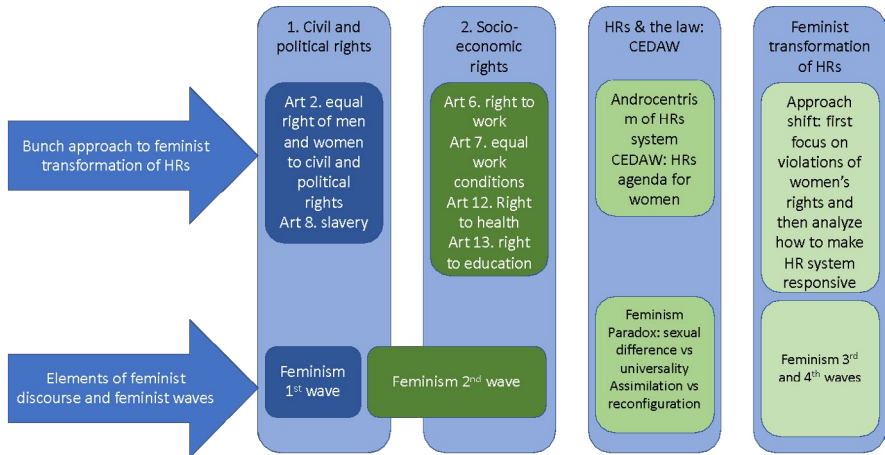
Hence, this paper is structured into four sections. First, a theoretical review of Bunch's proposal and how it could be translated into data feminism is presented. Second, the paper describes the contribution of data science and digital technologies to protecting and improving women's rights. The third section relates to the analysis performed on the identified apps and the study of the issues identified in the theoretical framework. Finally, the paper ends by drawing the main conclusions from the analysis and providing recommendations for a feminist transformation of data activism from a human rights approach.

This paper was presented in a panel chaired by one of the authors at the 2022 Science and Technology Sciences (STS) Conference in Graz, Austria. The feedback provided has contributed to improving the content, particularly the conclusions.

2. FEMINIST TRANSFORMATION OF HUMAN RIGHTS AND BIG DATA: RIGHT TO HEALTH

As Susan Moller Okin has stated, considering women's rights as human rights requires a «considerable rethinking of human rights» (Moller Okin, 1998). Even if nowadays there is consensus on this statement – «women's rights are human rights» – (Bunch 1990; Clinton, 1995; Gaer, 2009, p. 60; Grewal, 1999; Nussbaum, 2016; Peters, 2018; Peters et al., 2018), it was not until the late twentieth century that this consensus was achieved, and it was not an easy achievement.

Figure 1. Bunch’s approaches to women’s rights and feminist discourse



Source: prepared by authors

Bunch (1990) described her view on the feminist transformation of human rights, considering an approach with more transformational potential. It first looked at the violations of women’s rights and then challenged the human rights concept to make it «more responsive to women» (p. 496).

This way of addressing the violations of women’s human rights is connected with the intersectional approach promoted by feminism, especially in its third and fourth waves. Shiva’s definition of the feminist fourth wave (Shiva et al., 2019, p. 133) includes three fundamental criteria that are repeated in specialized literature: 1) the online nature of the movement, 2) the fight against sexual violence, and 3) the objective of intersectionality. The technological component of the fourth wave of feminism is essential since it represents a change of scenery from the one feminists faced first. Indeed, digital technologies not only impact the lives of women around the world but have also become an actual vehicle to channel their claims in the twenty-first century. This is where the transformation proposed by Bunch connects with the digital revolution and our approach to this article.

In a current context where digital technologies have become an element of feminism and a global force, it is necessary to analyze how they

can contribute to a feminist revision of women's rights. Smartphones and the internet, in particular, can be powerful tools for providing access to helpful information or even to resist and combat the stereotypical portrayal of women and prevent gender-based violence. Among other things, digitalization and new technologies can, for example, play a growing role in education and can be a catalyst to provide access to the educational system for the entire population or efficiently monitor health through information systems allowing, among other things, the registration of births and deaths, but also to provide health advice and appointment reminders or to promote health through campaigns and community mobilization (ITU, 2014).

Since the second wave of feminism, women's health and well-being have been on the women's rights agenda. Currently, the right to abortion as well as sexual and reproductive rights occupy a large part of the feminist agenda; likewise, the repercussions of the androcentric perspective of medicine on women's health are highlighted, especially given the backlash against women's rights. A direct consequence of this androcentrism of medicine is the higher incidence of certain diseases in women, the difficulty of correct diagnoses, and the scarce investigation of female disorders (Gemmati, 2020). More recently, it has been argued that the COVID-19 crisis has «exacerbated systemic and deeply entrenched gender inequalities» (De Vido, 2020). In this sense, the public health situation has been used to justify restrictions on women's rights to health – particularly reproductive health, and issues such as limited access to abortion or an increase in obstetric violence – under the disguise of policies and laws officially addressing the health emergency. In this context, digital technologies can help document and improve the analysis of some of these diseases. Still, they also carry significant risks, as some feminists have demounced after the reform of abortion law in the USA (Blum, 2022):

For this reason, we understand that it is essential to analyze and balance the pros and cons of *femtech* apps to determine if digital technologies can contribute to the feminist transformation of the right to health. It is important to note that we are aware of the limited access to *femtech* apps, especially in the global south and due to the gender digital divide. As mentioned above, we analyze whether the information that is gathered by these apps could contribute to improving women's health, particularly regarding

sexual and reproductive rights. However, our initial hypothesis is that the goal of these apps is far from improving women's health but limited to gathering personal data and hindering women's privacy. Nevertheless, if these apps were designed and applied from a feminist transformative approach, we argue that they could be a great tool to improve women's right to health, and this should be open to all women. To that end, first, we apply Bunch's proposal to analyze the challenges and violations of women's human right to health. Then, we determine the potential contribution of the field of *femtech* to improve women's health and consequently to the feminist transformation of the human right to health.

2.1. Identification of challenges around women's health issues

To identify women's health problems, it is necessary to distinguish three different sources of information: 1) issues that have received attention in the literature, 2) statistics on women's health problems, and 3) women's perception of their health problems.

2.1.1. *Women's health in the academic medical literature*

Throughout history, medical research has looked at women as men. Sexist stereotypes have caused scientific studies to under-represent women in their designs and interpretations. Thus, women have historically been excluded from medical tests, which have been limited to men; the results of male-only studies have been extrapolated to women (Holdcroft, 2007). These gender biases influence patient care, both because «research may adversely affect female care and contribute to the negative perceptions of female hysteria and the gap in time to diagnosis experienced by many women» (Merone et al., 2022, p. 57), and because they contribute to a growing distrust among women in the medical profession (Jackson, 2019, quoted in Merone et al., 2022, p. 50). Moreover, this bias results in under-diagnosis of women's diseases and symptoms, especially concerning cardiovascular disease (Gulati, 2017a) and in a concentration of doctors' interest in particular areas of women's health (mainly reproductive health and breast cancer), leading to what Nanette Wenger has called «bikini medicine» (quoted in Gulati, 2017b). Martha Gulati (2017a) argues that it is surprising that, although

cardiovascular disease (CVD) remains one of the leading women killers, surpassing breast, ovarian, uterine, cervical, or vaginal cancers and child-birth combined, the medical community continues to focus on the bikini boundaries.

These biases are reproduced in the interest of specialized medical literature. Thus, Esther Castaño-López states that the medical literature is divided between studies on «genuinely female» topics, such as uterine cancer, abortion, and menopause, and studies that analyze a health problem, habit, or factor separately for women and men (Castaño-López, 2006). In her study of medical research in Spain, she also identifies interest in topics related to this «bikini medicine» (sexual and reproductive health [39.2%] and mental health [12.4%]). (Merone et al., 2022) have also noted these inequalities in the medical literature. Based on a detailed review of articles in medical repositories published between 2009 and 2019, Merone et al conclude that «women remain vastly underrepresented in the medical literature, sex and gender are under-reported and under-analyzed in research and misogynistic perceptions continue to fuel the narrative» (Merone et al., 2022, p. 56).

2.1.2. Data on women's health problems

Drawing from Bunch, to determine the main obstacles to promoting and protecting women's right to health, it is necessary first to identify the leading women's health problems. However, access to data itself is a starting difficulty in the case of medicine and women's health, as it is reflected in the central repositories of data on women's health. For example, the World Health Organization's (WHO) Women's Health Portal³ provides data on three main topics: women's life expectancy, anemia, and maternal and reproductive health, and an analysis of the data provided in these sections shows that the areas for which significant data have been collected are those related to pregnancy, childbirth, and reproductive health. Another principal repository of health-related data, the Guttmacher Institute's data center,⁴ is structured around five main themes: contraception, pregnancy, abortion, births, and maternal and newborn health. These data reflect the aforementioned biased

3. <https://www.who.int/data/gho/data/themes/theme-details/GHO/women-and-health>

4. <https://data.guttmacher.org/regions?region=109>

focus on women's health and make it even harder to identify real women's health issues.

However, thanks to the contribution of the second wave of feminism, the gender perspective was highlighted as fundamental, resulting in the so-called gender medicine (Shai et al., 2021). This new approach to medicine aims to analyze the influence of gender on general medical issues and claims that modern medical knowledge is constructed on observations and trials conducted mainly on males. Thanks to this gendered approach to medicine, there is growing attention to women's health issues outside of the so-called bikini medicine. Thus, several studies point out that some of the more relevant threats to women's health are: cardiovascular diseases, stroke, cancer (including other types of cancer apart from gynecological cancers, such as lung or colorectal cancer, or melanoma), Chronic Obstructive Pulmonary Disease (COPD), autoimmune diseases, AIDs and mental illness (Services, 2001). Indeed, according to the *Lancet* (Mehran, 2019) and the European Society of Cardiology, cardiovascular disease (CVD) is the leading cause of death in women in Europe and worldwide (European Society of Cardiology, n.d.), and CVD in women remains «understudied, under-recognized, under-diagnosed, and undertreated» (Mehran, 2019).

A recent study from Health Metrics and Evaluation (IHME), The Global Burden of Disease study, finds approximately 275 million women worldwide with CVD, with a global age-standardized prevalence estimated at 6,402 cases per 100,000. Ischemic heart disease (47% of CVD deaths), followed by stroke (36% of CVD deaths), is the leading cause of death in women worldwide (IHME, 2019). Stroke is the fourth cause of death in women, according to the American Stroke Association (n.d.) and the National Center for Chronic Disease Prevention and Health Promotion (2022). Risk factors vary depending on sex, ethnic, and racial intersections (National Center for Chronic Disease Prevention and Health Promotion, 2022), as more African American and Hispanic women are diagnosed with high blood pressure, higher rates of obesity (nearly 3 in 5), and diabetes (more than 1 in 8), increasing their risk factors for a stroke. As for cancer, according to the OECD, the gender gap in mortality from cancer remains large in OECD countries, with mortality rates among men being nearly 70% higher than among women on average (OECD, 2017).

2.1.3. Women's perception of their health problems

A Mayo Clinic study published in the *American Journal of Health Behavior* investigates differences in how men and women perceive their health. The study finds that confidence in maintaining good health habits can be influenced by gender (Sood et al., 2019). According to Marta and Ana Gil-Lacruz (2019), men perceive their state of health more positively than women (p. 785), and this is due to psychological and physical conformation of identity, experiences related to female and male attributes, and lifestyles, and community variables, such as culture, norms, and sanctions (Caroli & Weber-Baghdiguian, 2016). This matter appears too in statistics, and according to Eurostat (see Image 1), men tend to gauge their health better than women.

Women's perception of their health problems also moves beyond sexual and reproductive health. A study on women's perception of their health in Beirut showed that, despite the significance of gynecological issues, women reported other health problems more, such as musculoskeletal problems, indicating competing health priorities (Zurayk, 2007, p. 631).

Yet, although medical evidence and women's self-perceptions place other diseases ahead of reproductive and sexual health, there has recently been a boom in the so-called *femtech*, mainly focused on «improving» gynecological, reproductive, and sexual health. Incorporating technological contributions to this field can be a significant breakthrough for collecting quality and representative data and identifying patterns and symptoms that go unnoticed in gender-based medicine. Therefore, in the following section, we will analyze this growing field, its characteristics and limitations, and its transformative potential for women's human right to health.

2.2. Promises and perils of the *femtech* field

Femtech is an emerging field related to health technologies that aim to bring to the front women's health through a broad range of tools and apps addressing menstrual, sexual, and procreative health (Hendl & Jansky, 2022). According to Brenda K. Wiederhold, this emerging field generated \$820.6 million in global revenue and \$592 million in total venture capital investment worldwide in 2019. In Europe, notably, it raised \$190 million in 2019 and was on track to make \$98 million year-to-date in 2020 (Wiederhold,

2021). This investment increase is also reflected in the number of start-ups that have emerged in *femtech*. According to the website [dealroom.co](https://app.dealroom.co), there are 382 worldwide⁵.

The boom has been greeted with expectations for its potential to reverse the gender bias that has traditionally dominated the medical industry and as a tool for women's empowerment (Hendl & Jansky, 2022, p. 30). The need for such approaches has been further reinforced in the aftermath of COVID-19, which has once again highlighted the persistence of gender biases (Thaler, 2022).

However, beyond the initial euphoria, there has been a critique from feminist studies, explicitly questioning the sector's contribution to real empowerment, highlighting the dangers of surveillance capitalism as manifested in women, and pointing out the lack of adequate regulation or the biased approaches of most of the sector's apps. A study by Tereza Hendl and Bianca Jansky (2022) shows that *femtech's* contribution to women's empowerment is limited to the discourse of the apps and questions whether it empowers users (p. 30). These authors analyze 14 apps to conclude that the language and content of these apps do not contribute to empowering users, making them understand and control their bodies; instead, they reinforce stereotypes and the stigmatization of menstruation. Furthermore, these authors connect menstrual surveillance with the oppression of surveillance capitalism (Hendl & Jansky, 2022).

Numerous studies warn that behind the boom of these applications lies yet another aspect of data capitalism and surveillance capitalism (Ford et al., 2021; Gilman, 2021; Johnson, 2021). Michele Estrin Gilman (2021) argues that the *femtech* sector is part of a «broader business strategy of data extraction, in which companies are extracting people's data for profit» (p. 100). Most of these apps make a profit with the information gathered from their the users by selling them to companies and platforms such as Google and Facebook (p. 100). Furthermore, she states that *femtech* is part of surveillance capitalism and sells these data after promising privacy and ethics standards.

5. https://app.dealroom.co/companies.startups/f/industries/anyof_health/keyword/anyof_femtech/launch_year_min/anyof_2011/tags/anyof_femtech?showMap=true&showStats=false&statsType last accessed 2-5-2022

In her critical approach to this emerging field, besides criticizing the biases and lack of intersectional and non-binary approaches of these apps, Gilman warns about the risk of discrimination that these apps may entail in the workplace. Elisabeth Brown (2021) also focuses on women's discrimination in the workplace through the use of these apps. But what is particularly relevant in Gilman's approach is her argument on data responsibility and the limitations of the law to protect users' data. Hendel and Jansky (2022) have already pointed out that the basis of the functioning of these applications lies in the users' introduction of the data they consider relevant in these systems, this being one of the main arguments of those who claim that this field contributes to female empowerment. However, Gilman points out that the *femtech* sector not only takes advantage of the data that users enter into apps but also places the responsibility for controlling and protecting their privacy on them rather than on the tech companies themselves. In the case of Gilman's study, she identifies weaknesses in the American legal system for data protection. In Europe, although there is *a priori* better safeguards through the General Data Protection Regulation, Catriona MacMillan (2021) says that these applications fail to protect users' data because they are unclear about how they share and use them, reinforcing the asymmetry of power in data protection (p. 17).

Nevertheless, Gilman (2021) points out that these apps could substantially contribute to transforming and improving women's health if their design were centered on the voices of those directly impacted by them, including female medical staff (p. 12). Besides, more cooperation with the education and health systems is needed to improve medical research, paying attention to ethics and data protection (Gilman, 2021, p. 12). This statement connects with the approach proposed by Bunch for a feminist transformation of women's rights since a critical analysis of women's needs places the protection of rights, and the empowerment and respect for diversity at the center.

In the following sections, we analyze key aspects like permissions, trackers, and other privacy-related elements applied to an exhaustive analysis carried out on 45 applications to try to elucidate the contribution these tools make and the contribution they could make (Braña, 2019).

3. DATA SCIENCE CONTRIBUTION TO A FEMINIST TRANSFORMATION OF HUMAN RIGHTS FEMTECH APPS

The rise of *femtech* is driven by its growing importance in the economic field. However, this new trend may have a more significant impact than merely financial. As has been shown in other areas, such as industry (Braña, 2019), tourism (Imtiaz & Kim, 2019), or transport (Genzorova et al., 2019), digitization is a revolution that significantly alters the environment. Alongside its dangers, digitization can generate new opportunities and analyze these sectors from different perspectives.

This system is increasingly being questioned, as the results are often not applicable to the real world. A clear example of this is the work presented by Wyants et al. (2020). They analyzed more than 37,000 articles that included 232 predictive models for detecting COVID-19 in radiographs. The study concluded that all models were rated at high or unclear bias risk, mostly because of the non-representative selection of control patients, exclusion of patients who had not experienced the event of interest by the study's end, high risk of model overfitting, and unclear reporting (Wyants et al., 2020, p. 1). They have also allowed the development of new devices that can detect different conditions in real-time, such as irregular heart rhythms.

These technologies also work in sports performance, analyzing aspects of the game and aspects related to the players' health, capturing and analyzing data to minimize the injuries they suffer, and maximizing performance. Besides, many of these technologies are available through apps like Strava and Apple Fitness.

Despite the success of these applications, several scholars have shown their caution, criticizing them for reproducing and reinforcing dominant social inequalities, including binary sex-gender norms and sexist stereotypes, among many issues (Bjørn & Menendez-Blanco, 2019, p. 30). Some also point out the disparities in the tech industry and the dominance of men in a field that offers health services to women (Bjørn & Menendez-Blanco, 2019, p. 30).

Most of these apps are based on the data provided by the users and extract knowledge from them. Catherine D'Ignazio and Lauren F. Klein

(2020) proposed a new way of thinking about data science, combining it with the perspective of intersectional feminism. They identified seven different aspects that the inclusion of this perspective could provide:

- Examine the power as the first step to analyzing how power operates.
- Challenge the power, commit unequal power structures, and work toward justice.
- Elevate emotion and embodiment.
- Rethink binaries and hierarchies, challenging other systems of counting and classification that perpetuate oppression.
- Embrace pluralism, based on the idea that complete knowledge comes from synthesizing multiple perspectives.
- Consider context, considering that data are noted as neutral or objective.
- Make this labor visible.

Based on these principles, for example, apps could elevate the relevance of feelings and include them as a critical element of women's health. Likewise, they can displace the fertility and control of periods as a central element of the apps, which can increase the pressure on women when it comes to wanting to get pregnant.

However, the lack of inclusion of this perspective in data science and machine learning modeling means this feminist data revolution is not happening. The lack of inclusion of feminist perspectives in medicine implies that this transformation has not yet occurred despite its potential. The promise of the *femtech* revolution has not yet arrived.

Below we will analyze the current state of women's health apps in one of the largest mobile app stores and see what these apps are doing with the data they collect.

4. ANALYSIS OF EXISTING WOMEN'S HEALTH APPS

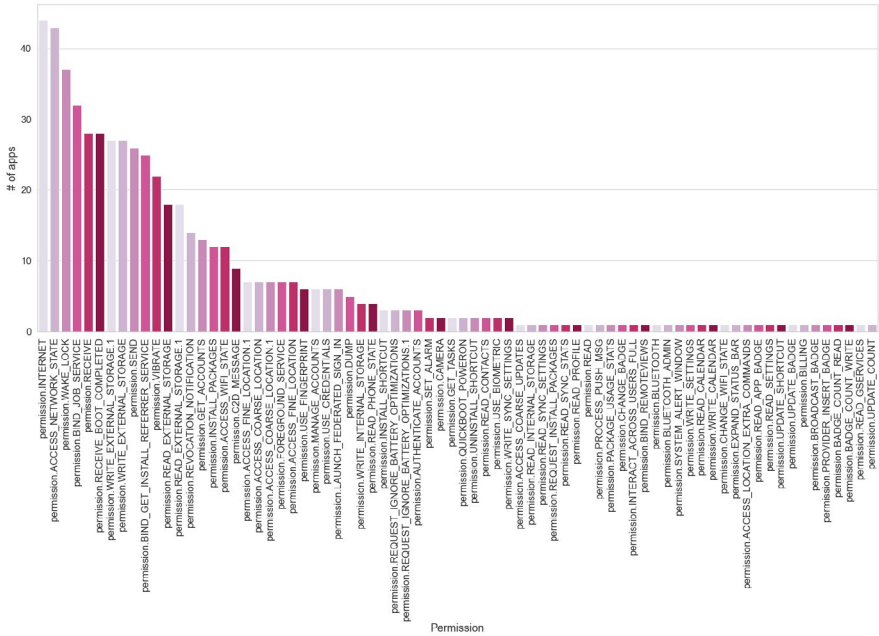
We have carried out several searches in the official Google application store, Google Play Store, to carry out this analysis. To evaluate the state of these applications, we chose to analyze those related to the monitoring of menstruation. The reason is twofold. On the one hand, they are the most

abundant type of female apps within app stores. In addition, they are made of applications that, to carry out their work, should only store information and access it since aspects such as geolocation, for example, should not be required to be able to use it.

We have used keywords like «menstruation», «period», and «women's health» and downloaded the 45 apps that frequently appear under those searches. We investigated the different permissions of the applications to see what each type of application tries to do. When the program is installed, these permissions are evaluated, and the user must authorize them. We extracted and decrypted data from the Android SDK's `AndroidManifest.xml` file using the Android Asset Packaging Tool (`aapt`). After that, we dumped and analyzed the data. We only used the «uses-permission» from all of our information, which specifies the application's permissions.

According to Figure 2, the most common permissions are related to internet access. It should be noted that many of the requested permissions are not directly related to the activity that the application assumes. Several are related to standard practices when developing applications, such as `ACCESS_NETWORK_STATE`. However, from the point of view of privacy, this type of permission can pose a risk since, for example, it grants access to network connections and thus can identify the user's movements pattern, along with other data.

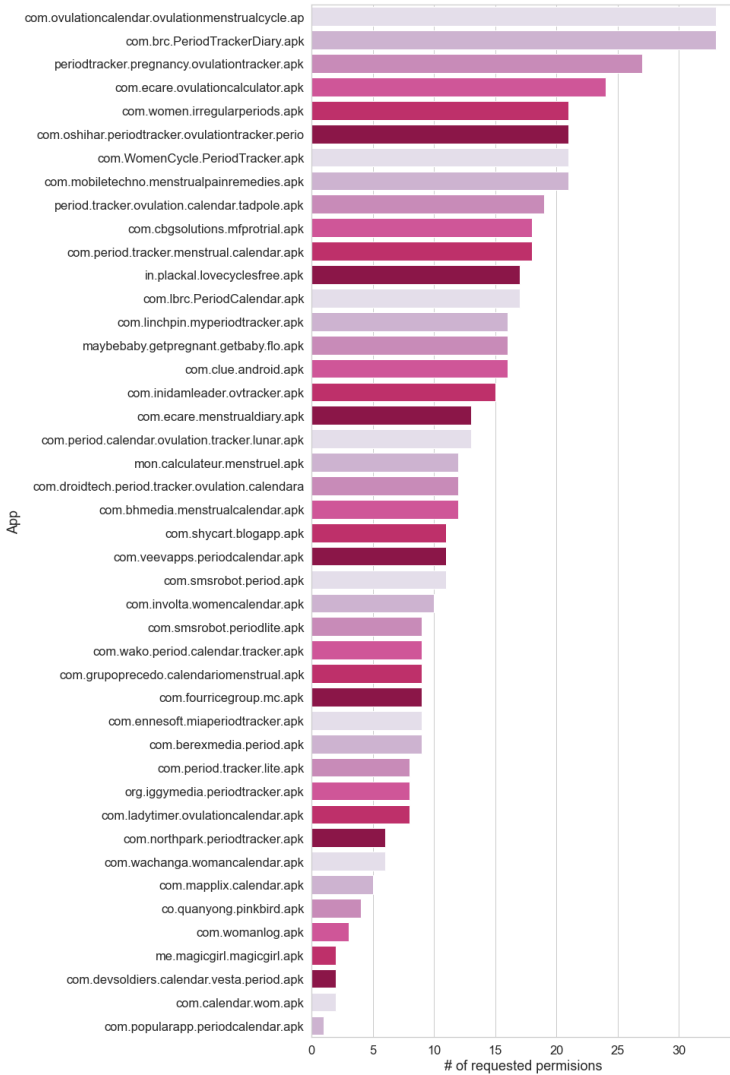
Figure 2. Most requested permissions in the analyzed apps



Source: prepared by authors

On the other hand, we conducted a study regarding the number of permissions of each application (shown in Figure 3). The average number of permits requested is 12.8, and the deviation is 7.7.

Figure 3. The number of permissions requested by each analyzed app



Source: prepared by authors

Table 1. Permissions requested and the percentage of apps where this permission appears. Most of these descriptions have been obtained from the official Android documentation (<https://developer.android.com/>)

PERMISSION	% of apps that use this permission	Description
android.permission.INTERNET	100%	Allows applications to open network sockets.
android.permission.ACCESS_NETWORK_STATE	98%	Allows applications to access information about networks.
android.permission.WAKE_LOCK	84%	Allows using PowerManager WakeLocks to keep processor from sleeping or screen from dimming.
android.permission.RECEIVE_BOOT_COMPLETED	64%	Allows an application to receive the Intent. ACTION_BOOT_COMPLETED that is broadcast after the system finishes booting.
com.google.android.c2dm.permission.RECEIVE	64%	Allows apps to accept cloud to device messages sent by the app's service. Using this service will incur data usage. Malicious apps could cause excess data usage.
android.permission.WRITE_EXTERNAL_STORAGE	62%	Allows an application to write to external storage.
com.google.android.finsky.permission.BIND_GET_INSTALL_REFERRER_SERVICE	58%	The RECEIVE receives push notifications, and Firebase uses the BIND_GET_INSTALL_REFERRER_SERVICE to recognize where the app was installed.

android.permission.VIBRATE	51%	Allows access to the vibrator.
com.android.vending.BILLING	47%	Allows apps to process transactions and make in-app purchases through Google Play.
android.permission.READ_EXTERNAL_STORAGE	42%	Allows an application to read from external storage.
android.permission.ACCESS_WIFI_STATE	29%	Allows applications to access information about Wi-Fi networks.
android.permission.GET_ACCOUNTS	29%	Allows access to the list of accounts in the Accounts Service.
android.permission.USE_FINGERPRINT	16%	This constant was deprecated in API level 28. Applications should request USE_BIOMETRIC instead.
android.permission.ACCESS_COARSE_LOCATION	16%	Allows an app to access approximate location.
android.permission.FOREGROUND_SERVICE	16%	Allows a regular application to use Service.start foreground.
android.permission.ACCESS_FINE_LOCATION	16%	Allows an app to access precise location.

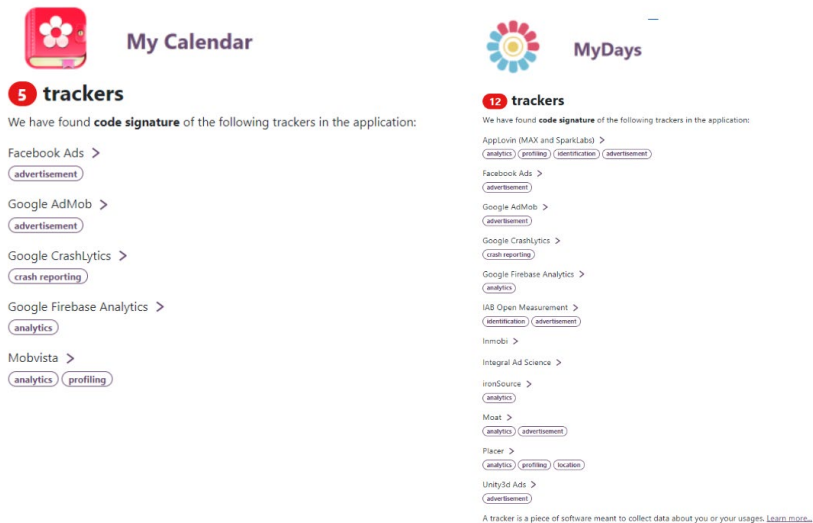
Source: prepared by authors

As we can see, these permissions have little or no relation to an application that, in theory, should only store information about the period and show it to the user. Many of these permissions are typically used in bookstores to collect information about the user, to obtain information about their location, tastes, or mood, thus directing advertising more effectively. These results align with the so-called surveillance capitalism and with how applications today extensively use user data to optimize online advertising. The results also indicate that the different aspects discussed before, such as using health

data to empower women or improve women's perception of their health, are not present in these apps.

To learn more about the inside of these applications, we used the exodus⁶ that allowed us to analyze the type of Source Code that the application has, the libraries it operates, and the number of permissions it requires. Figure 5 shows two applications selected and analyzed with this tool as an example.

Figure 5. Some examples of the number of trackers that have this type of application



Source: Exodus app

We conclude that most women's health applications on the market aim to collect information from users to exploit the information to improve the accuracy of the advertising systems. By requesting permissions that are not necessary for the application, they seek to be able to collect as much information as possible from users. In addition, these applications aim to focus on

6. <https://reports.exodus-privacy.eu.org/>

period and fertility, thus tracking aspects to optimize women's reproductive capacity.

On the other hand, thanks to these applications, a large amount of information is being collected regarding different aspects of women's health that could be used in various types of research with a real impact on women's health.

5. DISCUSSION AND CONCLUSIONS

The field of *femtech* today does not improve women's health or contribute to their empowerment. On the contrary, it seeks to extract an economic return on the data the apps gather and the commercial profiling they can do on women, which is evident from the trackers and data the apps collect. Indeed, this platform's business model is based on the exploitation of user data and pays little regard to user needs or the impact the information gathered could have if shared with third parties. An example of this is consumers abandoning their usual *femtech* apps in search of better privacy after the fall of *Roe v. Wade*, fearing that prosecutors could weaponize health app data, alongside other digital trails of data, in cases related to abortion. The status of these apps is linked to the lack of application of a transformative feminist approach in this field. As a result, stereotypes and biases that contribute to the oppression of women and app narratives are reproduced.

This preliminary study has focused on determining what types of permissions applications request without going into detail about what information they store and how they manage it. Broader research would be needed to decide which data women enter into these apps and to see if this could improve research on women's health. Moreover, qualitative research to deepen the self-perception of women's reproductive rights and health and the accessibility of these apps would be needed. It would also be relevant to evaluate the treatment the technological companies make of that report, i.e., if it is processed locally or sent to their servers.

Several reasons can explain the presence of so many trackers. For example, developers may copy the permissions' configuration file from one application to another, dragging even those unnecessary. However, as we saw, these permissions are oriented to extract user information. In this first

analysis, we have not delved into whether they use these permissions. Still, a preliminary analysis of the existing trackers indicates that the final objective is monetizing the apps.

This new sector must incorporate transformative elements of Bunch's proposal: to identify women's problems beyond bikini medicine and traditional biases. Based on Bunch's recommendation, these applications must be developed from proposals that respect women's dignity and rights, including the right to privacy. One important aspect linked to the potential for feminist transformation of these apps is the gender bias of the technological sector, where women are only the object and barely the subject developing these apps. The growing literature about the gender-biased nature of digital technology showcases the limited representation of women in the sector, which undoubtedly impacts the development of these apps. These biases relate not only to the scarce representation of women but also to the role played by companies and start-ups in the research and innovation sector, resulting in a clear orientation to make profit. Situated knowledge from women technologists could help bring this sector closer to a transformative approach. Finally, despite the advances in the regulation of the technology sector, it is clear that it is necessary to improve the protection instruments, incorporating elements of accessibility and commitment to intersectional approaches.

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