Menstrual Tracking Apps in India : User Perceptions, Attitudes, and Implications

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Abstract

The use of mobile applications as health-tracking platforms has been increasing worldwide. This trend has been observed in India as well. Menstrual tracking applications, or MTAs, are one such category of "mHealth" apps that have been gaining popularity. However, the scholarship in this area has not satisfactorily considered this niche phenomenon, especially in the Indian context. This article presented novel findings from a study conducted on 464 women from different parts of the country. A mixed-methods approach was employed to understand user perceptions, knowledge, and practices on MTAs. The study indicated good awareness of MTAs. Women use MTAs for various reasons, from tracking their cycles to planning sexual activity. The women in the study had an overall positive outlook toward MTAs. The insights from the study also suggested the need for various stakeholders, such as the app-makers and regulatory bodies, to step in and recognize some of the concerns of the users. These include issues of data privacy, lack of medical grounding, etc. The article also discussed various implications that are relevant for the stakeholders. The study's findings showed that young women in India are embracing their menstruating bodies with the help of digital tools like MTAs. The present study also emphasized the importance of personalization in MTAs to support the varied motives of the users and the need for collaboration between various stakeholders to fulfill user needs.

Keywords : MTA, period tracking, menstruation, mHealth, fertility apps

Since the late 20th century, digital technologies designed to generate and share health information have emerged. This rise can be traced to the mid-1990s when the Internet and World Wide Web came into being, and information websites, mailing lists, blogs, and other platforms of online discussion were established. People could now access medical information and share their own experiences with others. Nowadays, smartphones connected via the internet, mobile apps, social media, and even wearable self-tracking devices like smartwatches and fitness trackers have enabled people to seek personalized health information online at any time and generate unprecedented amounts of their health data and experiences. As the world takes to digital platforms for health information, mobile health applications are gaining widespread popularity. Health self-tracking is becoming increasingly popular among youngsters (Fox & Duggan, 2013). Mobile-based health apps have seen

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unprecedented growth in the last few years, especially fitness apps. Studies such as Kesharwani and Roy (2017) have looked at the various factors that affect the diffusion of these "mHealth" apps in the Indian scenario. Menstrual tracking apps (MTAs) are a prominent type of health app that allow us to evaluate the dependability and tracking frequency of millions of women, providing an unequaled picture, both in detail and scale, of menstrual health and its progression for big populations. Individuals are increasingly expected to be digitally involved patients who actively use digital technologies to seek information about health and medical issues as well as maintain and promote their health (Lupton, 2013).

The gendered aspects of digital health technology use have received very little attention. Women's physiological experiences, such as menopause or premenstrual syndrome, are frequently overlooked (Epstein et al., 2017). Most women of reproductive age see a gynecologist or another clinician regularly to monitor their menstrual health and fertility. These visits are distinguished by patient evaluations based on memory-based self-reports. Sadly, young women often fail to remember even the last date of their menstrual period or their flow to help doctors come to a better diagnosis. This is where technological tools come into the picture: to conveniently aid young women in logging data related to their health and keep track of the same. A significant portion of the Indian female population is raised with very little knowledge regarding reproductive health, pre-menstrual stress, period symptoms, or period-related illnesses such as endometriosis. This is because menstruation is shrouded in secrecy and is associated with social taboos (Garg & Anand, 2015).

The use of period-tracking mobile applications is becoming increasingly common among young urban women in India (Chaudhuri, 2016). These apps are intended to help women keep track of their menstrual cycles and fertility periods, allowing them to plan for conception or contraception. They are also becoming an important source of reproductive information, acting as a personal companion in most women's pockets. This study constitutes novel findings on digital menstrual tracking practices among young women in India. The study focuses on analyzing the knowledge, attitudes, and practices of young Indian women concerning MTAs, which would help us understand various aspects of female reproductive health communication in India. The findings can be used to assess the effectiveness of the medium in equipping women with the requisite knowledge about their bodies and menstruation and reproduction in general. This will also help regulate these apps with necessary medical certification and clinical expertise. Developers and medical practitioners can work together to devise the necessary changes to improve and enhance these apps for better accuracy, reliability, and security. Specific managerial implications concerning MTAs are also discussed.

Literature Review

Menstrual Tracking Applications (MTAs)

In a study on US female college students by Richman et al. (2014), 46% of smartphone owners said tracking periods would be the most beneficial function of a mobile health app. Lupton (2014) critically examined sexual and reproductive mobile apps, including menstrual-tracker mobile apps, and discovered that menstrual-tracker mobile apps and fertility-tracker mobile apps are frequently grouped. Mobile reproductive apps promote women to think about their reproductive health in medical terms and urge them to believe that they are in charge of monitoring their bodies and documenting and controlling their sexual behaviors, with pregnancy as the primary aim (Lupton, 2014).

A period-tracking mobile app, or a menstrual-tracking app, has a variety of uses and benefits. Most of them have the following functions (Thompson, 2016):

✎ Predict future menstrual cycles.

✤ Track fertility to plan conception.

✤ Track moods, energy levels, sexual activity, sex drive, insomnia, flow, spotting, and other symptoms, before, during, and after menstruation.

✤ Remind users to change pads/tampons.

✤ Discuss menstruation with others who use the app in a discussion forum.

✤ Reach out to medical practitioners to ask questions.

Besides a calendar that helps track menstrual activity, some of these applications allow users to input temperature, weight, and period-related symptoms such as cramps, mood swings, body pains, breast tenderness, and bloating. Ovulation dates and "fertile days" are also marked on apps like M Calendar and Period Tracker, which are frequently colored pink. Menstrual-tracker smartphone applications can help women keep track of their menstrual cycles and better understand their bodies (Hines, 2013). The applications keep track of the users' menstrual cycles so that they may share more precise information with their doctors to help them spot any health issues (Flynn, 2015).

In a study conducted in the UK, four main motivations for using MTAs were identified; they were mostly used to observe the menstrual cycle. Other motives included assisting in conception, assisting in fertility treatment, and informing about contraception (Gambier- Ross et al., 2018). Four major themes in women's relationships with MTAs are: identified medical foundation, trackers versus non-trackers, design, and social and ethical considerations (Gambier-Ross et al., 2018). The study also found that most women felt that MTAs were highly educational, providing women with a safe environment for reproductive health communication. Studies have pointed out that MTAs have become more than a digitalized tool for keeping track of the bleeding days. Most users have found assurance and an escape from stigma in these apps (Karlsson, 2019). Further, MTAs provide women a way of "reclaiming their bodies," as the female body is not embraced by most cultures. In this context, MTAs become "shame-free rooms" for exploring and engaging with menstruating bodies (Karlsson, 2019).

Popular MTAs

✤ Flo

✤ Glow

✤ Clue

✤ Period Tracker

✤ Pink Pad

There are several Indian MTAs, such as "Maya," "Nyra," and "Niine" that are available to consumers.

MTAs – Critical Perspectives

Much like most technologies, menstrual tracking apps have also been receiving a good share of criticism. This whole notion of "fem-tech" is expected to grow to a 50 billion-dollar industry by 2025 (Tiffany, 2018). And yet it remains a male-dominated sector, with only 10% of the market share going to women-led startups (Tiffany, 2018).

The main concern raised by a lot of academics is data security, privacy, and the commercialization of sensitive data. Levy (2019) coined the term "intimate surveillance," given the lack of regulation despite the popularity of

these menstrual tracking apps. It is questionable that these apps still do not meet the privacy standards or the reliability required of most doctors and hospitals, making it extremely easy to sell targeted advertisement content (Kresge et al., 2019).

It is extremely valuable for marketers to get access to reproductive data. Hence, these apps often become another avenue for the commercialization of pregnancy (Peterson, 2016). There are no laws that protect personal health information from being sold, disclosed, or traded for any purpose, be it marketing or research (Peterson, 2016). A consumer reports test run on Glow, one of the most popular period tracking apps, found that it could be hacked by people who did not even possess any hacking skills (Beilinson, 2020). This is huge given the fact that Glow even asks for very intimate information like sex positions and satisfaction.

Another major concern is accuracy, again stemming from a lack of regulation and standardization. Columbia University Medical Centre ran a test on 108 of the free menstrual tracking apps, and deemed 95% of them as inaccurate, in that they do not cite medical literature or have health professionals' involvement (Moglia et al., 2016). In India, there is absolutely no government body that checks the health insights that young women receive through these apps ("Don't rely on period apps," 2018).

There are also significant feminist concerns about the user interface of these apps. Like most female-targeted products, menstrual monitoring apps have a "shrink it and pink it" mentality (Tiffany, 2018). These apps are characterized by bizarrely pink aesthetic features such as floating clouds, unnecessary flowers, and peculiar faux-empowering language instead of simple medical terms, an approach largely attributed to male developers (Tiffany, 2018). On the other hand, many period-tracking mobile apps perpetuate rather old-school gender assumptions (Hines, 2013).

Lupton (2015) lamented the "objective neutrality" imposed by these reproductive self-tracking and quantitative measurement practices on what is a very subjective action of human beings. The body then becomes a mere subject as well as a product of scientific measurement and interpretation (Lupton, 2015). Sex and individual rhythms of the body are reduced to mere numbers. Despite the market being flooded with MTAs, there is not a single regulatory body in India that approves MTAs before they enter into the market. This causes a massive disparity in how "medically sound" each app is (Gambier-Ross et al., 2018). Women who use MTAs can have vastly different experiences based on the app they use and how they use it. Beyond commercial market research conducted by private companies, there is still a lack of knowledge about how women choose these apps and whether medical backing is important to them. Nature Cycles is the first, and still, the only mobile application cleared for marketing as a certified contraceptive in Europe (Gambier-Ross et al., 2018). This is the first step towards MTAs being recognized and certified by medical practitioners as a credible form of contraception or conception.

Conceptual Framework

Knowledge, Attitudes, and Practices (KAP) Survey Model

In developing countries, knowledge, attitude, and practices (KAP) surveys are routinely used to collect data for public health program planning. A KAP survey is often used to gather data on a population's knowledge (i.e., what they know), attitudes (i.e., what they think), and behaviors (i.e., what they do) on a variety of general and/or specialized subjects (World Health Organization, 2014).

The KAP survey was devised in the field of family planning and population research in the 1950s. They were designed to understand the reluctance of people to various family planning methods, and this understanding was used to design family planning programs around the world. Since then, the KAP model has established itself as a widely used methodology for investigating health behavior and obtaining information on health-seeking practices (Launiala, 2009).

Knowledge

A KAP survey is used to first understand the extent of community knowledge about the said public health concept. It also segregates beliefs from knowledge. While beliefs refer to traditional ideas that are deemed erroneous from a biomedical perspective, knowledge is based on scientific facts (Launiala, 2009).
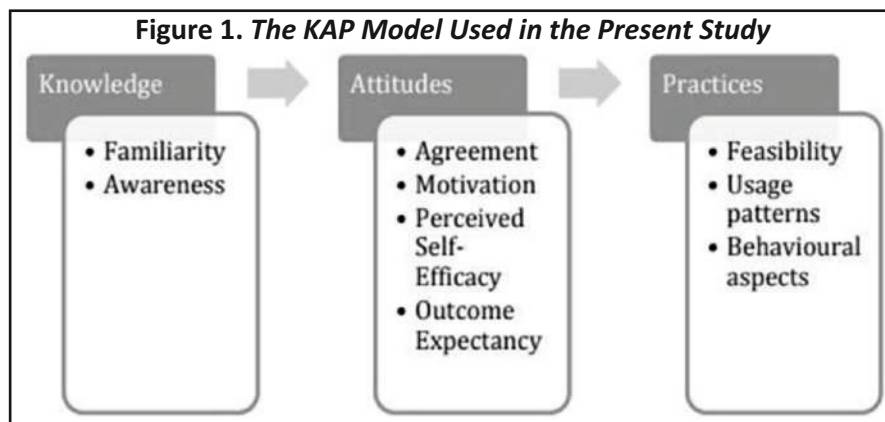
Attitudes

A KAP survey does not give results regarding attitudes owing to the risk of incorrectly generalizing the opinions and attitudes of a particular group or community. The word attitude means one's feelings about an issue, object, or person. But in this context, it is important to understand that attitudes stem from the knowledge, ideas, feelings, and values of a person (Launiala, 2009).

Practices

The examination of health-related practices is a third and essential component of KAP surveys. This shows the behavioral aspect of the community. It is also mentioned that knowledge is just one of the factors affecting the practices, and there should be a lot of factors ranging from socio-cultural to environmental, economical, and structural factors, etc., that should be taken into account while planning a public health program based on the survey (Launiala, 2009).

The KAP model is traditionally used in public health settings before planning interventions and programs. In the present study, the KAP framework was used to formulate the questionnaire to measure the knowledge, attitudes, and practices of Indian women on menstrual tracking applications. The KAP model is known for its reliability, in that it allows the generalization of small sample results to a wide population and across various cultures (Launiala, 2009). Figure 1 shows the KAP model used to investigate MTA users and usage in the present study..

Figure 1. *The KAP Model Used in the Present Study*

Objectives

⮩ To examine the knowledge, attitudes, and practices of young women regarding the utility of mobile-based applications for menstrual tracking.

Methodology

A mixed-methods approach involving quantitative as well as qualitative methods was employed for the present study. An online survey was administered for quantitative analysis, whereas in-depth interviews (IDIs) were done to collect qualitative data. The study was carried out between September 2020 – January 2021.

Survey

A knowledge, attitudes, and practices (KAP) survey on MTAs was conducted. The questionnaire was designed using Google Forms, a free platform for hosting surveys. Participants were mostly recruited using social media platforms, including WhatsApp and Facebook. Social media was utilized because of its capacity to acquire data cheaply and swiftly. In addition, it allows researchers to communicate directly with possible study volunteers who would otherwise be difficult to contact. The survey was available on the platform for one week. The survey results were kept anonymous unless a participant wanted to engage in a follow-up interview, in which case a name and phone number were requested to facilitate a follow-up contact. These recruitment approaches were employed to guarantee that the sample was sufficiently diversified. The nature of the study was explained to all participants, and their informed consent was obtained.

A 5-point Likert scale was presented to the respondents to choose the specific attitude they associated with a given statement. The scale contained numbers ranging from 1 – 5, the specifics of which are: 1- *Strongly Disagree*; 2- *Disagree*; 3 - *Neutral (Neither Agree nor Disagree)*; 4- *Agree*; 5- *Strongly Agree*.

In-Depth Interviews (IDIs)

The attitudes part of a KAP survey suggests a follow-up, especially in the case of sensitive issues (Launiala, 2009)."Hence, in-depth interviews were employed as a follow-up on five respondents of the survey. Follow-up interviews to seek clarification regarding the survey's open-ended questions took place over the phone. Each interview was recorded and lasted 20 – 30 minutes. The interviews were transcribed and analyzed promptly. Participants were chosen for interviews based on their responses to the survey to get a wide range of perspectives on the topic. A more select group of respondents who gave their permission for an interview was chosen and contacted based on data of interest gleaned from the free-text responses. This was done to clarify data that was inconsistent or to elicit more in-depth comments. In addition, informed consent was obtained from each participant before interviews got underway.

Sampling

The study used purposive sampling. This is a type of non-probability sampling that is often used by mass media researchers (Wimmer & Dominick, 2003). Here, participants or respondents are selected for specific qualities, and it eliminates those who fail to meet the required criteria. This is typically employed to select respondents who utilize a particular media (Wimmer & Dominick, 2003).

The respondents of the survey had to meet the inclusion criteria, which were as follows:

✥ Be a woman;

✥ Should be experiencing menstruation.

Prior experience using MTAs was not a requirement to participate in the survey. Inclusion was based on self-reported information given by the participants.

Pilot Study

The online survey was piloted among 11 female postgraduate students at a private Indian university to ensure that the survey did not have any technical, wording, or branching issues. It was asked if the term 'menstrual cycle' or the term 'periods' was preferred and easier to understand. Accordingly, the survey used the word 'periods' instead of 'menstruation.' Other recommendations were on changing the wording around sensitive words and including more options in some questions. The relevant changes were made accordingly.

Data Analysis and Results

Survey Results

Demographics

The survey yielded 464 responses from various parts of the country. The age bracket of the respondents was 18 – 33 years, and the average age was 22.85 (SD = 2.22); 65.7 % of the respondents were students; whereas, 30.8% of the respondents were employed, and only 0.6% were identified as homemakers; 60% of the sample indicated Kerala as their "state of origin." However, there was representation from Karnataka (6.5%), Tamil Nadu (13.4%), Maharashtra (5.2%), and a few other states as well. Table 1 shows the participant representation from the various states of India. The majority of the respondents were students (65.7%), and the rest were mostly employed (30.8%). Other categories, like homemakers, unemployed, etc., had negligible responses (refer to Table 1 for other demographic attributes).

Table 1. *Demographics*

State of Origin	
Kerala	60.1%
Tamil Nadu	13.4%
Karnataka	6.5%
Maharashtra	5.2%
Delhi	1.9%
Occupation	
Students	65.7%
Employed	30.8%
Homemakers and Others	3.5%
Educational Qualification	
High School	1.3%
Undergraduate	42.7%
Postgraduate and above	56%
Place of Residence	
Urban	50.1%
University Hub	15.1%
Semi-Urban	19.7%
Rural	15.1%

More than half of the respondents reported having regular periods ($n = 235$, 50.6%). Among the rest, most reported more or less regular periods. This amounted to 33.6% of the sample ($n = 156$); 12.1% of the sample reported irregular periods ($n = 56$), and only 3.7% of the respondents reported highly irregular periods ($n = 17$). Table 2 depicts the general menstrual pattern of the sample.

When asked to mention if they had any menstrual cycle-related clinical conditions as an open-ended question in the survey, 19 responses were recorded. Of them, Polycystic Ovary Syndrome (PCOS) was reported by most ($n = 13$). Two people mentioned that they had some level of hormonal imbalance, and another two respondents mentioned that they had Hypothyroidism. Also, one person each reported having Dysmenorrhea and Premenstrual Dysphoric Disorder. It is to be noted that such people's experiences would be deviant from that of the normal population. The sample contained 282 (60.8% of the sample) non-users of MTAs and 182 (39.2% of the sample) users.

Knowledge

Table 3 represents the various aspects that were examined regarding the "Knowledge" element of the modified KAP framework.

Attitudes

Table 4 represents the various aspects that were examined concerning the "Attitudes" element within the KAP framework. A 5-point Likert scale was used to measure attitudes regarding MTAs and MTA use.

Practices

Active users of MTAs were limited to 78% ($n = 142$) of the sample. Table 5 shows the distribution of users of different MTAs. This is from the subset of 182 MTA users.

Table 2. *General Menstrual Pattern of the Sample*

Menstrual Pattern	Percentage
Regular	50.6% ($n = 235$)
More or less regular	33.6% ($n = 156$)
Irregular	12.1% ($n = 56$)
Highly irregular	3.7% ($n = 17$)

Table 3. *Knowledge*

Awareness of MTAs	77.6% ($n = 360$) of the sample reported being aware of MTAs, whereas 22.4% ($n = 104$) reported being unaware of such apps.
Interest in installing MTAs among non-users ($n = 282$)	36.5% of the non-users were not interested in installing MTAs. However, 33.6% were neutral, and 29.9% were interested in installing an MTA.
Exposure to MTAs	Through a friend/relative – 40.1%
	Read online – 28 %
	Google Play Store/ App Store – 31.3%
	Celebrity – 0.5%

Table 4. *Attitudes*

Statement	SD	D	N	A	SA
I feel I'm well-equipped with information regarding menstruation and menstrual hygiene practices.	1.1%	4.9%	22.5%	35.2%	36.3%
I feel I understand my body better since I started using an MTA.	8.8%	9.9%	36.3%	29.1%	15.9%
I find it easier to sail through my period due to my MTA.	5.5%	6%	22%	36.5%	29.7%
Sometimes, I find the app is inaccurate.	28%	30.2%	24.2%	12.1%	5.5%
I find the health tips in the app to be informative.	6.6%	15.9%	41.2%	22%	14.3%
I feel MTAs are a safe, private space to store and receive reproductive information.	5.5%	10.4%	24.2%	33%	26.9%
I feel embarrassed opening the app in front of other people.	55.5%	17%	13.2%	7.7%	6.6%

Table 5. *Usage of Different MTAs in the Sample*

MTA	Users
Flo	30.7%
My Calendar	25%
Maya	17.9%
Period Tracker	7.1%
Clue	5.7%
Wonder Period	2.1%
My Cycles	1.4%
Eve	1.4%
Period Calendar	1.4%
Others	7.3%

Table 6. *Usage Data*

Usage History	
Less than a month	9.3%
1 – 6 months	24.2%
7 – 12 months	26.3%
More than a year	40.2%
Frequency of Use	
Hardly ever	21.3%
Once in a while	11.5%
Regularly	42.3%
Only when I'm on my period	25.9%

Users of the MTA Flo had the highest representation in the sample (30.7 %). The sample also had users of the Indian MTA Maya (17.9%); 42.5% of the total sample used some kind of health-tracking mobile app; 57.9% of this subset of the sample were MTA users. The survey was designed to uncover usage data in terms of the frequency of

use as well as data on how long the MTA users in the sample had been using the apps. The results are furnished in Table 6.

The survey also measured the various motivations for individuals to use menstrual tracking applications. Some of the major motivations considered were tracking moods and symptoms, monitoring the menstrual cycle, gathering general information on menstruation, etc. Table 7 shows the results for the motivations.

As evident from Table 7, the motivations based on popularity are :

↳ Monitoring cycle/Understanding irregularities

↳ Gathering general menstrual information

↳ Understanding the body better

↳ Tracking moods and symptoms

↳ Planning sexual activity

The respondents were asked to indicate some of the features they found essential within MTAs. These features are noted below from most popular to least popular:

↳ Daily health tips

↳ Medical help

↳ Fertile phase reminder

↳ Mood and symptom prediction

↳ Password locking

↳ Integration with other health apps

Another aspect the survey was able to uncover was the users' knowledge about MTA regulation. The vast majority of the users (83.5%) were unsure of whether the app they used was regulated by the government or medical boards, and 12.6% of the respondents noted that their MTA was not authorized by any institution. Only 3.8% of the total users in the sample indicated that the app they used had medical grounding and approval. A clear majority of women (78.6%) in the user group said they would recommend MTAs to other women.

The survey also contained open-ended questions on (a) reasons for stopping MTA usage and (b) suggestions to improve the in-app experience. Below are the major themes that were identified from these questions:

Table 7. *Motivations for MTA Usage*

Motivation	Percentage
Monitor my cycle/ Understand irregularities	77.5%
General menstrual info	68.7%
Track my moods and symptoms	39%
Understand my body better	25.3%
Plan my sexual activity	20.9%

(a) Reasons for Stopping MTA Usage

- Irregular periods
- Inaccuracies in the app
- Ability to track cycle by themselves
- Too much storage space
- Didn't find it very effective

(b) Recommended Improvements to MTAs

- Privacy and security of data
- Interoperability with other health apps
- More health tips
- Inclusiveness of women with irregular cycles
- Password locking
- Due date reminders
- Networking with medical practitioners
- Eliminate advertisements

Results of In-Depth Interviews (IDIs)

Five users of MTAs were contacted for a follow-up interview based on the responses to the open-ended questions in the survey. The researchers tried to include a good variety of users to get different perspectives of the users of menstrual tracking apps. The participants were assigned codes to protect their identities. Table 8 gives an overview of the details of the participants. The mean age of the participants was 23.6 years.

The in-depth interviews were thoroughly examined. The audio file was played back after each interview and was transcribed verbatim. To identify the developing categories, a critical evaluation of the transcripts was undertaken. This analysis was utilized to collect further information from subsequent interviews. After all of the

Table 8. *Participant Details for IDIs*

ID	Age	Menstrual Status	Use MTAs?	Educational Status	State of Origin	Why use MTAs?
P1	22	More or less regular	Yes, Flo, Clue, and currently, Maya	Postgraduate	Odisha	Monitor cycle, track moods
P2	23	Regular	Used to, My Calendar	Postgraduate	Maharashtra	Monitor cycle
P3	26	Regular	Yes, Period Tracker	Postgraduate	Kerala	Monitor cycle, track moods
P4	23	More or less regular	Yes, Maya	Undergraduate	Tamil Nadu	Monitor cycle, track moods
P5	24	Regular	Yes, My Calendar	Postgraduate	Tamil Nadu	Monitor cycle, track moods

interviews were completed, a final analysis was carried out. To uncover the overarching subthemes, all interview transcripts were coded using open coding approaches. When the repeating subthemes were identified, they were combined to form broader themes.

Convenience

Most women started using menstrual tracking apps purely because of convenience. Now that smartphones have become an extension of our bodies, most women find it easier to log their menstrual information on their smartphones. Three out of the five participants reported that they randomly searched for an app to track their menstrual cycle on Google Play Store, and that was how they came across it. It was also noted that three of the participants had been habituated to the app they used, and they had been using it for a couple of years. This could be because most women use it as a basis to track their due dates.

Social Recommendation

It is also interesting to note that all five participants said they were earlier used to their mothers keeping track of their dates on a calendar. All the participants mentioned that their mothers had suggested menstrual tracking, but not specifically via an app. This corroborates several Indian studies pointing out that the mother is the primary source of menstrual information for most women in the country.

It was noted that most participants actively discussed the apps among peer networks, which is how they came to know about new apps. This could be because most youngsters are more comfortable with their friends rather than their family to talk about such sensitive issues. Also, interestingly, an Indian app, Maya, was the most popular among peer networks of all the participants.

Education

All the participants reported that they were well-equipped with menstrual health information before they started using menstrual tracking apps. However, they felt that the knowledge they had was "very general" (P1), and it was only through the app that they could explore it to understand it at a personal level. Interestingly, almost all the participants agreed that the notion of how menstruation happens at a personal level was something they found with the menstrual tracking apps. This is evidence of how educational MTAs have been to most young women.

Prediction

All the participants reported that they searched for health information online. This is another trend prevalent among youngsters. The participants were hence in the habit of reading more health information online, and not just the app. Accuracy was very important for most participants. All the participants said that the predictions of moods and symptoms were helpful and necessary. It was also noted that it helped them acknowledge Premenstrual Syndrome (PMS) and understand it better. This also corresponds to the high preference for an MTA that can track moods and symptoms in the survey. PMS and bodily changes throughout the cycle are rarely acknowledged in most cultures, and therefore, women find an opportunity to understand their menstruating bodies better through these apps.

Interface

Two respondents commented on the interface of menstrual tracking apps. Unlike a lot of discourse in the West

about the sexist interface of most MTAs, the participants did not find anything unusual about it. None of the participants commented about the "pink and flowery interface"; in fact, some preferred such an interface. This could be because MTAs are not as widespread in their use in India as in the West. This could also be a cultural difference.

Free Versions vs. Paid Versions

All the participants reported using a free version of the MTAs, and this could be because they only have an elementary use of MTAs. Most young women with low purchasing power could be sticking to free versions because they only need a basic digital calendar to track their dates. One participant said that she switched to Maya from Clue because most of the features were available only in the paid version of Clue. In general, the participants said that they were not willing to pay for menstrual tracking apps. Further, one participant lamented on the push of advertisements in the free versions.

Privacy and Other Concerns

Two participants raised the question of privacy. This shows that with the rise of MTA usage in India, more women are becoming aware of the more significant problems like privacy attached to it. Two participants felt that the apps were too generalized. Another respondent said that she feels she cannot rely on it too much because enough medical practitioners do not back it.

Discussion of Findings

The study finds that most young women are aware of menstrual tracking apps. Despite the high awareness, familiarity and effective knowledge of the apps is quite low. Only two - fifth of the sample had used menstrual tracking apps, but the rest indicated some level of interest in trying it. This is comparable to the findings of a study in the UK, which found that only one-third of the female population was using menstrual tracking apps (Gambier-Ross et al., 2018). The study also found that a clear majority of women were unaware whether the app they used was backed by medical practitioners or regulated by the government. This suggests that unlike studies in the West (e.g., Gambier-Ross et al., 2018; Hines, 2013; Thompson, 2016; Tiffany, 2018), Indian women did not give any importance to the medical grounding of the apps they used. It was found that the majority of the apps found popular in the study are the free apps that are the first ones listed on Google Play Store if you search for 'Period Tracker.' Also, the most popular app was found to be Flo, unlike other studies in the West, where Clue was the most used app. This could be because most features of Clue are limited to the paid version, and the study showed that Indian women stuck to only the free versions of these apps and were unwilling to pay for them. Also, an Indian app, Maya, was found to be the most well-known MTA among the study participants. English is the preferred language in India for sensitive topics like menstruation (Tuli et al., 2019), which is further corroborated by this study. Most women also commented on the need for more information regarding menstruation and their bodies, which is comparable to an Indian study on menstruation (Wagh et al., 2018). In India, women came across these apps randomly on the Internet or based on social recommendations.

Overall, positive attitudes toward menstrual tracking apps are noted. The study found that women indeed found menstrual tracking apps convenient and highly educational. Almost all women agreed that they didn't find menstrual tracking apps embarrassing and weren't ashamed to open the app in front of others. While Western reports (Hines, 2013; Thompson, 2016; Tiffany, 2018) have suggested that women are bothered about the "pinkification" of the app and criticized the lack of clinical presentation in the interface of such apps, this study found that Indian women did not have any such concerns. Some women even found the pink interface with cute

icons appealing, pleasant, and like a friend they can confide in. This could probably be because such apps are just starting in India and are not as widespread as in the West. Almost all women agreed that such apps provided a safe environment for women to understand more about menstruation, which is also comparable to a UK study (Gambier-Ross et al., 2018). An Indian study (Ray & Dasgupta, 2012) found that one-third of young women in urban areas felt they had no correct knowledge of the causes of menstruation. But the rise of digital health platforms seems to have been able to bridge that gap. A study on E-health services by Dash et al. (2022) may provide useful insights for MTA manufacturers to improve adoption and usage.

Managerial Implications

The expansion and usage of health apps in India have been aided by digital transformation and strong government assistance. The country's digital footprint has been bolstered by a rapid increase in the number of mobile subscribers and Internet users. In 2020, 810 million people had a smartphone; by 2026, that figure is predicted to rise to 1.2 billion (Research and Markets, 2021). However, the insights from this study indicate several issues that need to be addressed if businesses are to build a long-term, profitable business model.

✎ *Address Data Privacy Issues.* Privacy issues are not just limited to health apps today. This has, in fact, become a common talking point for techno-critics and pessimists of internet-based technologies ranging from smartphones to self-driving cars. A paper (Grundy et al., 2019) published in the *BMJ* highlighted the opacity of data-sharing practices of mobile health applications. The article emphasized the need for privacy regulation. Therefore, developers should declare all data-sharing policies and allow consumers to choose exactly what data is shared and with whom. These practices would also enable app makers to build trust with their audiences.

✎ *Address the Absence of Medical Approval.* Many of the popular MTAs have no medical grounding. As long as the medical establishment is not involved in the regulation of mHealth apps, the app makers have the ability to indulge in unfair practices by providing inaccurate or unscientific information through their products. However, it should also be noted that having some kind of medical approval would make the app more credible. It has already been found that "satisfaction" is the most important factor influencing young women's continued use of mobile applications (Gadhiya & Panchal, 2021). Addressing some of these issues can help increase users' satisfaction and allow businesses to retain their customers.

✎ *Better Integration with Other Health Apps.* The study's findings suggest that MTAs can become powerful tools when integrated with other health apps. This was a common sentiment among the study participants.

✎ *Improve Marketing Strategies.* Of the 464 women who participated in the study, only 182 were MTA users. Although this is not a pan-Indian sample, the findings indicate a lack of marketing efforts to capitalize on this growing market. Also, the majority of MTA users were exposed to these apps through word of mouth or random Google searches. Jain (2022) and others have stressed the importance of rethinking business and marketing strategies in the post-COVID era. This is absolutely essential if MTAs want to survive in a competitive segment. The Government of India must also step in and amend the IT Act or create new policies for regulating mobile applications, especially health applications.

Limitations of the Study and Scope for Further Research

There is minimal literature on female digital health technologies and their implications in the Indian scenario. The present study attempted to uncover some of the underlying patterns of MTA use in India. However, the sample is

not fully representative, and the findings of this study cannot be extrapolated to the larger population. The insights can be applied to a middle-class, urban/semi-urban context. There are unlimited possibilities in exploring this country's gendered dimensions of health and health tracking as it is a largely untouched subject. Some of the findings from this study can be examined and validated in different economic, social, and cultural contexts. In light of Tabeck and Singh (2022), another possible future direction would be to explore how bottom-of-the-pyramid (BOP) users adopt health technologies.

Authors' Contribution

Sauparnika R. Krishna carried out the study under the supervision of Dr. Padmakumar K. Dr. Padmakumar K. verified the analytical methods and offered insights during the course of the study. Ananthu Nair wrote the manuscript in consultation with Dr. Padmakumar K.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter, or materials discussed in this manuscript.

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