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Original Article

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Background: The overturning of *Roe v. Wade* in June 2022 has many implications for American women of reproductive age, as well as for researchers focused on women's health in the United States (U.S.). Personal reproductive health data, such as information collected by menstrual cycle (MC) tracking applications (apps), can now be bought, sold, or accessed by law enforcement to enforce limits on abortion. American women have grown concerned about data privacy and have even deleted MC tracking apps following the overturning of *Roe v. Wade*. This concern is problematic as these apps may advance our understanding of women's MC experiences by capturing time-sensitive data. The present study was designed to provide updated insight into women's perceptions of these apps, including the response rate to a study of this nature and women's willingness to self-report demographic information in this context, following the Supreme Court decision.

Methods: A total of 206 women aged 18–60 years who were identified as pre- or perimenopausal completed an anonymous, cross-sectional survey between August and November 2022.

Results: Most respondents had experience using a MC app at the time of reporting; 53.4% (n=110) were current users, and an additional 48 participants had used MC tracking apps in the past. Over one-third of participants (38.3%; n=75) indicated that they had reconsidered using such an app because of current events; 30.3% (n=59) preferred methods of MC tracking that did not involve app-based technology, and 34.2% (n=67) reported that they are not willing to participate in research that involves daily tracking of the MC.

Conclusions: Overall, the feasibility of menstruation-related research that includes mobile apps is fairly low, given women's current comfort with this technology compared to the Roe era, and there is a need to establish criteria and protections for use of mobile apps in women's health research.

Keywords: Mobile applications (mobile apps); mobile health (mHealth); electronic health (eHealth); healthcare policy; menstrual cycle (MC)

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Introduction

Background

The menstrual cycle (MC) represents a highly individualized experience for women (1), and one that is often surrounded by silence, shame, and stigma (2). Due to possible internalization of gender roles, social norms, embarrassment, or taboo, women themselves may not always self-disclose about their MC experiences (e.g., menstrual cramps, pain, fatigue, mood swings). Thus, timely self-monitoring of this health experience is valuable, as it provides insight and self-awareness of one's general health and how one's body responds to different phases of the MC, which can inform conversations with healthcare providers (3). Such insight can promote a detailed understanding of physical and psychological symptoms in the natural environment.

The development of mobile health (mHealth) technologies for monitoring the MC (i.e., "period tracking applications") represents a technological advance in the areas of mHealth and healthcare that can support the pursuit of this detailed understanding (4). MC tracking applications (apps) have been downloaded by millions worldwide (5) and are an extension of more traditional approaches such as paper records, digital calendars, and hormonal methods such as contraceptives (3). They also hold potential to bridge the gap between research and practice by capturing time-sensitive data about MC patterns and physical, psychological, and social experiences of women that are otherwise difficult to collect. These data can be used to facilitate tailored, adaptive interventions, as well as inform improvements in clinical decision-making and healthcare for women.

Highlight box

Key findings

- Despite the widespread availability of menstrual cycle (MC) tracking applications (apps), American women have concerns about app-based tracking of the MC. These concerns are also applicable for data collected in the context of research participation.

What is known and what is new?

- App-supported MC tracking has grown in recent years compared to other methods.
- However, non-electronic methods should be considered for menstrual literacy and recall of reproductive health data, if fear or mistrust associated with app-based technologies has surfaced due to recent events in the United States.

What is the implication, and what should change now?

- Policymakers and developers of MC tracking apps should consider ways to safeguard women's personal reproductive health data and reassure women that these health data remain private.
- Future studies, especially longer-term studies collecting MC data over time, should be aimed at developing methods and procedures that allow for safe storing of these health data.

The current context of app-based MC tracking

On June 24, 2022, the United States (U.S.) Supreme Court overturned its prior decision in *Roe v. Wade*, ending federal protections for women's right to abortion and related reproductive healthcare that were established in 1973 (6). This decision and its societal consequences have health and safety implications for American women of reproductive age, including effects on healthcare. Limits on abortion may also conflict with privacy safeguards for the personal health information that is frequently gathered and shared through mobile apps, fitness trackers, social media platforms, and websites. Critically, MC tracking apps and related technology are not Health Insurance Portability and Accountability Act (HIPAA)-regulated or protected by medical confidentiality (i.e., privacy protected), and there is concern that personal reproductive health data could be bought, sold, or accessed by law enforcement and used to establish a timeline or criteria for pregnancy post-Roe (7,8). Thus, the recent overturning of *Roe v. Wade* has led American women to grow increasingly concerned over their use of MC tracking apps, and has resulted in many women deleting their personal MC tracking apps (9). News outlets and social media brought attention to this issue and MC tracking app users may now be fearful of how their personal health information could be used against them in a hypothetical criminal case about abortion (7-9).

Data on the use of menstruation and fertility app trackers before the overturning of *Roe v. Wade* are available. For example, a study was conducted in 2017 to investigate how women track their MCs. At that time, less than half of survey respondents (45.6%; 313 out of 687) used a mHealth app for MC tracking. Other methods cited by participants were digital calendars (12%), paper diaries (8%), following cues in birth control (12%), noticing symptoms (7%), or simply remembering (19%), and a small subset (11%) did not track their MC (3). In 2018, a survey study of 241 women showed that just over one-third of participants used a MC tracking app; of that subset, 98% found the apps to be useful, informative, and educational (10). A scoping review of 18 relevant articles

was published in 2021, with the majority of included studies conducted in the U.S. This review concluded that women are motivated to track their MC for a variety of reasons: to understand their body across MC phases, to be prepared so their period does not surprise them, as a method of contraception, to conceive, and to inform fertility treatment or conversations with a healthcare provider (11). Importantly, these motivations can change, or overlap, over time (12). Also of note, there has been a general growth in the accessibility of mHealth apps over time. As of July 2019, 49 apps were commercially available in the Google Play and Apple App stores, with many app features and functions offered for free (13). The current landscape of women's reproductive healthcare in the U.S. may contribute to—and likely inhibit—how mHealth apps are used in clinical health care, research, and practice moving forward. Consequently, there is an urgent need to better understand women's current perceptions of MC tracking apps, and importantly, their willingness to use these apps in future research studies.

Aims of the present study

Given the recent overturning of *Roe v. Wade* and subsequent concerns about data privacy and protections, this is an ideal time to update our understanding of women's comfort with app-based MC tracking technologies. This updated information would allow researchers (as well as practitioners and policy makers) to use these mHealth technologies appropriately in the current climate and indicate whether criteria need to be established to provide additional data protections. In line with these goals, the first aim of this cross-sectional study was to determine the response rate for a survey about women's use of MC tracking apps soon after the overturning of *Roe v. Wade*, and the timescale for such data collection (i.e., to achieve a sample size of 200 women). The second aim was to determine the proportions of women who report willingness (*vs.* unwillingness) to use MC tracking apps in research settings, as well as their perceptions of using other methods to collect this information (e.g., paper records). The third aim was to determine whether and to what extent women would self-report demographic information alongside their perceptions of MC tracking apps, given the context of the decision to overturn *Roe v. Wade*. We present this article in accordance with the STROBE reporting checklist (available at https://mhealth.amegroups.com/article/view/10.21037/mhealth-23-31/rc).

Methods

Women between the ages of 18–60 years were invited to complete an anonymous, cross-sectional survey between August and November of 2022—i.e., in the 3 months following the U.S. Supreme Court's decision to overturn *Roe v. Wade* (*Dobbs v. Jackson Women's Health Organization*). Other inclusion criteria were (I) residing in the U.S.; and (II) reporting ownership of a mobile device that they used regularly. Women were recruited via electronic announcements sent to employees and students at the supporting institution (including multiple affiliated campuses, all in the northeastern U.S.) and via social media posts (e.g., Twitter, Facebook). Social media ads were posted on the research team's official website, Twitter, and Facebook, as well as the personal social media accounts of members of the research team. The research team used specific language to advertise for this study, asking for women to help us understand how they use apps that allow for self-monitoring of health experiences (e.g., physical activity, menstruation). Physical activity tracking, for example, was included in the study description because some physical activity monitors and apps also allow MC tracking; this allowed the research team to capture all users and experiences of MC tracking features that may be embedded in mHealth technologies other than those apps specifically advertised for self-monitoring of the MC.

An anonymous survey was administered via web-based software (Qualtrics, Provo, UT, U.S.). The geolocation data settings on Qualtrics were turned off (i.e., GPS location, IP address) to ensure each response was anonymized. The research team considered asking respondents to report their general location (e.g., state in the U.S.). Ultimately, we chose not to include this question, to prioritize participant comfort and privacy concerns, given the sensitivity of the topic in the context of the recent Supreme Court decision. Participation took approximately 20 minutes and participants were not offered compensation. Informed consent was documented electronically at the beginning of the survey and each participant was asked to verify that they met eligibility criteria. The electronic consent form explained that each response was completely anonymous and that the information provided was confidential and could not be traced back to participants. This study was approved by the Rowan University Institutional Review Board (No. PRO-2022-203) and was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

Table 1 Survey items capturing women's experiences with MC self-monitoring

Survey items	Response options
Are you currently tracking your MC with an app?	Yes
	No
If yes, how long have you been using this app? If no, have you previously used a MC tracking app?*	1 month
	2–3 months
	4–5 months
	6 months
	>6 months–1 year
	More than 1 year
As a result of current events in the U.S., have you reconsidered the usage of MC tracking apps?	Yes
	No
As a result of current events in the U.S., how would you prefer to track your MC?	Handwritten note
	Digital note
	Current app
	Different app than I am currently using
	Electronic spreadsheet
	Other (please specify)
Under what circumstances are you currently willing to track your MC using an app?	To store my personal health data
	As part of my participation in a research study
	None of the above
At this time, would you consider volunteering to participate in a research study that involved the daily tracking of your MC?	Yes
	No
At this time, how would you prefer to track your MC if you were participating in a research study?	Handwritten records
	App (such as the Fitbit app)
	Electronic spreadsheet (such as Excel or Google sheet)
	No preference

*, text box entry was available for those who previously used an app to explain why app use was terminated. MC, menstrual cycle; app, application; U.S., United States.

Measures

The main focus of the survey was on self-monitoring of health experiences with mobile apps. All questions relevant to participants' experiences with MC self-monitoring are reported here. Items were carefully designed due to the sensitivity of the topic area at the time of data collection. Participants were asked to answer the following questions and were provided the following response options: (I) are you currently tracking your MC with an app? Yes/no (If yes, how long have you been using this app? If no, have you previously used a MC tracking app?). Participants who endorsed that they were an ex-user had the opportunity to give additional context via a survey item designed to assess when app usage was terminated. Participants also had the option to indicate why use was terminated via an open-ended question (i.e., text box entry). The next set of questions focused on MC tracking (see *Table 1* for full text and response options): (II) as a result of current events in the U.S., have you reconsidered the usage of MC tracking apps? (III) As a result of current events in the U.S., how

Table 2 Survey missing responses (of n=206 total)

Items	N (%)
As a result of current events in the U.S., have you reconsidered using a MC tracking app?	10 (4.9)
As a result of current events in the U.S., how would you prefer to track your MC?	11 (5.3)
Under what circumstances are you currently willing to track your MC using an app? To store my personal health data	9 (4.4)
At this time, would you consider volunteering to participate in a research study that involved the daily tracking of your MC?	10 (4.9)
At this time, how would you prefer to track your MC if you were participating in a research study?	9 (4.4)
Menopause status	49 (23.8)
Total household income	52 (25.2)
Education level	49 (23.8)
Race	53 (25.7)
Ethnicity	49 (23.8)
Marriage status	48 (23.3)

U.S., United States; MC, menstrual cycle; app, application.

would you prefer to track your MC? (IV) Under what circumstances are you currently willing to track your MC using an app? (V) At this time, would you consider volunteering to participate in a research study that involved the daily tracking of your MC? (VI) At this time, how would you prefer to track your MC if you were participating in a research study?

Display and skip logic were added to the survey to enable follow-up questions to appear as they were relevant to participants' responses. The survey also included demographic questions, including ethnicity, race, household income, and education level. These questions were placed at the end of the survey and participants could choose not to answer. The demographics assessment also offered women the opportunity to specify their age and menopause status, as the timing of the menopause transition varies among menstruating individuals, and those who did not identify as pre- or perimenopausal were removed from analyses (i.e., those who were no longer menstruating due to menopause or surgery; n=53).

Statistical analysis

Data analysis included descriptive statistics (e.g., frequencies, means) using SPSS version 28 (IBM Corp., Armonk, NY, USA). The data were split, using the split file option, to compare frequency distributions across different subsets (see below). In addition, the minimal qualitative data provided were grouped based on topic, for ease of interpretation.

Results

The first aim of this report was to determine the response rate to a survey about MC tracking in the immediate social and legal context, and the timeframe to achieve a substantial sample size (i.e., 200 women). Of the 259 women who participated in this study, 206 identified as pre and/or perimenopausal; thus 206 participants were included in the following analyses. Achieving this sample size took 15 weeks (August 8th–November 21st, 2022). The frequency and percentage of missingness from each survey item and demographics assessment are reported in *Table 2*.

At the time of data collection, 53.4% of this sample (n=110) were currently using a MC tracking app. Of this subset, 74.5% (n=82) reported use of a MC tracking app for ≥1 year. Of those not using a MC app at the time of study participation (46.6%; n=96), 50.0% (n=48) were ex-users (or past users). Approximately 6.0% (6.3%; n=6) of these respondents terminated their MC app use 2–3 months prior to study participation, and 4.2% (n=4) terminated their use 4–5 months prior. Of the 48 ex-users, 43 completed the qualitative survey item and 13 responses were particularly relevant to the context of this study. These responses were grouped into the three categories highlighted in *Table 3*: (I) *Roe v. Wade*; (II) privacy concerns; and (III) control of my data. More than half of participants (n=7) specified the Supreme Court decision in their responses. For example,

Table 3 Responses to Q 'Please indicate why you stopped using a MC tracking app' grouped into topic categories

Categories	Frequency (n)
Roe v. Wade	7
Privacy concerns	3
Control of my data/data access	3

Q, question; MC, menstrual cycle; app, application.

"*Roe v. Wade* being overturned". Others identified data privacy concerns (n=3), "I didn't want that information out there", as well as limiting others' (e.g., companies, advertisers) access to these data (n=3); "I didn't like the idea of my data being sent to advertisers and other large companies" and "I taught myself how to track my own cycle. I felt uncomfortable with a company having data of my MC".

Our second aim was to determine women's comfort with using (i.e., willingness to use) MC tracking apps and other methods of MC self-monitoring in future research studies. Roughly 40% of all eligible participants (38.3%; n=75) indicated that they had reconsidered using a MC tracking app due to recent events in the U.S. (e.g., the overturning of *Roe v. Wade*, privacy concerns). When participants were asked to endorse their preferred MC tracking method as a result of current events, nearly one-third (30.3%; n=59) reported a preference for methods that did not involve app-based technology, such as written records (i.e., handwritten note or physical calendar; 19.0%; n=37), digital records (i.e., digital note in smartphone; 7.7%; n=15), electronic spreadsheet (i.e., Excel spreadsheet; 1.5%; n=3) or other methods (e.g., birth control pill or intrauterine device; 2.1%; n=4). Although 34.9% (n=68) of participants endorsed using their current app as their preferred method of MC tracking, a small percentage (7.2%; n=14) indicated that they would prefer to use an app other than the one they were using at the time of data collection.

Importantly, 58.4% of participants (n=115) reported that they were not currently willing to store personal health data using a MC tracking app. Although 65.8% of participants (n=129) indicated that they would consider volunteering to participate in a research study that involved daily MC tracking, only 37.1% (n=73) were willing to participate if data collection methods included use of a mHealth app (e.g., Fitbit MC tracking feature). A subset of participants (31.5%; n=62) reported that they did not have a preferred MC tracking method for participating in a research study, while others (31.5%; n=62) preferred a non-app-based method such as handwritten records (16.2%; n=32) or electronic spreadsheet (15.2%; n=30).

The third aim of this study was to determine the extent to which women would self-report any demographic information in a survey about MC tracking, given the current societal impact and legal circumstances. Of 206 total respondents, 52 women (or 25.2%) declined to report any demographic information. The remaining 74.8% of this sample provided some demographic information such as age and body mass index (BMI; mean age, 29.70 years; mean BMI, 25.94 kg/m^2). *Table 2* shows the frequency and percentage of the demographics assessment and other survey items. Available demographic information is presented in *Table 4*. For instance, 92.4% (n=145) of participants self-reported pre-menopause status, and 73.9% (n=122) of participants identified as White. The majority of participants identified as never married (62.7%; n=99), reported a household income >$75,000 per year (59.1%; n=91), and indicated that they had at least a Bachelor's degree (62.4%; n=98).

As an exploratory follow-up, we compared survey responses of those who reported demographic information *vs.* those who did not. At the time of data collection, 53.9% (n=83) of those who reported demographic information were MC tracking app users, whereas 40.4% (n=21) of non-demographic reporters were not; however, 10 of these participants were past users. Of those who provided demographic information, 39.0% (n=60) indicated that they had reconsidered using a MC tracking app due to recent events in the U.S., and 30.9% of this subgroup preferred non-app-based methods (e.g., handwritten records, digital records, electronic spreadsheet, birth control). Roughly 35.0% (34.9%) of non-demographic providers indicated that they reconsidered MC app use due to recent events in the U.S., and 27.9% of this subgroup preferred non-app-based MC tracking methods. Importantly, more than half of participants in both groups reported that they were not currently willing to store personal health data using a MC tracking app (62.8% of demographic providers; 57.1% of non-providers). A majority of participants in both groups did indicate that they would consider volunteering to participate in a research study that involved daily MC tracking; 64.9% (n=100) who did and 55.8% (n=29) who did not provide demographics. If participating in a research study, however, only 33.8% of respondents who shared their demographics and 48.8% of respondents who did not were

Table 4 Participant demographics and descriptive statistics

Variables	Value (n=206)
Age (years), mean ± SD	29.70±9.96
BMI (kg/m^2), mean ± SD	25.94±6.28
Menopause status†, n (%)	
Premenopause	145 (92.4)
Perimenopause	12 (7.6)
Racial identification†, n (%)	
Caucasian/White	122 (73.9)
African American/Black	12 (7.3)
Asian or Pacific Islander	11 (6.7)
Hispanic/Latina	12 (7.3)
Mixed/other	8 (4.8)
Household income†, n (%)	
<$25,000	8 (5.2)
$25,000–<$50,000	29 (18.8)
$50,000–$75,000	26 (16.9)
>$75,000	91 (59.1)
Marital status†, n (%)	
Never married	99 (62.7)
Widowed	1 (0.6)
Divorced	7 (4.4)
Separated	1 (0.6)
Married	50 (31.6)
Highest education level†, n (%)	
High school or GED	26 (16.6)
Associate's degree, technical degree, or partial college	33 (21.0)
Bachelor's degree	36 (22.9)
Graduate or professional degree	62 (39.5)

†, available data out of total n=206. SD, standard deviation; BMI, body mass index; GED, general education development.

willing to participate if data collection methods included a mHealth app for MC tracking.

Discussion

The present study was designed to determine U.S. women's comfort with MC tracking technology, particularly its use in a research study, after the overturning of *Roe v. Wade*. In the present study, 53.4% of participants were MC app users. Although our targeting of health app users may have contributed to larger subsets of MC app users in this study (relative to prior work), there has been a general growth in the accessibility and awareness of MC mHealth apps over time. MC tracking apps are widely available to women and are a cost-effective solution to monitor reproductive health.

Yet, findings from the present study show that, despite the widespread availability of mHealth apps MC tracking, a large subset of menstruating women in the U.S. have concerns about app-based MC tracking, including MC data collected for personal health management and data collected in a research context. Given that 86% of participants had been using a MC tracking app for at least 6 months, it is noteworthy that about two-thirds of women in this sample indicated reconsideration of MC tracking app use, and 13 participants who ceased their app use indicated that their reconsideration was due to *Roe v. Wade*, privacy concerns, or having control over their personal health data. As there have been threats to utilize these data to prosecute individuals suspected of obtaining abortion care (14), this novel finding highlights the effects that such policies can have on women's use of free and available tools to track their health information.

Thus, women may be willing to change their habitual self-monitoring behaviors (i.e., app use) despite their known educational value (12), due to fear of data privacy or the spread of misinformation about their data privacy. Previous research suggests that women liked mHealth apps for MC tracking because of the discrete nature of this technology (3), keeping their MC information in an app was perceived as offering more privacy than handwritten records. However, companies such as Fitbit have recently indicated that they would turn over users' app data if requested for legal purposes (15). It appears that some concern is warranted, and widespread awareness of such policies immediately after the overturning of *Roe v. Wade* may help to explain the results of this study (7-9).

Importantly, more than half of participants in the present sample reported that they were not currently willing to store personal health data using a MC tracking app, and this may have negative implications for women's understanding of their own health behaviors and patterns (3). This may also translate to broader limitations on self-disclosure of MC information. Social stigma is attached to menstruation (16), and findings from several studies have revealed that women feel a need to conceal menstrual bleeding, as it has been

considered a private and intimate matter (1,17-20). The current social and legal climate in the U.S. post-Roe could further reinforce menstrual stigma or the spread of misinformation about women's reproductive health, as well as interfere with future menstrual literacy.

Although about 40% of participants in the current study preferred an app for MC tracking, a small percentage (7.2%) preferred to use a different app than the one they were currently using. This may be due to mobile app terms and agreements or concerns of data privacy, though the exact reasons are not clear. Previous research has identified that women have preferences for a MC app interface: MC apps have often used stereotypically feminine attributes (i.e., colors or designs) that exacerbated privacy concerns, and therefore, could contribute to this finding (10). Color schemes, icons, app names, or notifications to one's lockscreen could draw unwanted attention from others as well as cause embarrassment. Thus, the benefit of using a dedicated app to store personal information may not allow women privacy if using these apps in front of others.

In addition, one-third of participants in this study preferred MC tracking methods that did not involve an app; however, they still indicated willingness to do so using other methods (e.g., handwritten notes). Thus, findings indicate that women see benefits of MC tracking for their own reproductive health, and may explore other (non-digital), more traditional methods post-Roe (or switch MC tracking apps). Future research should aim to evaluate which apps women choose and feel comfortable using in light of the Supreme Court decision, collect data about the particular concerns of MC tracking apps, and assess attitudes about abortion or assess perceived likelihood of needing or seeking abortion care. These factors may contribute to app preference in the current environment.

Implications for future research using MC tracking apps

Of particular concern for future research in this area, two-thirds of participants reported that they were not willing to store their personal health information using a MC tracking app, and 40% of participants in the sample indicated that they would not be willing to participate in a research study that involved daily MC tracking. These findings confirm that, despite the availability and utility of MC tracking apps, many women in the U.S. have concerns about electronic MC tracking, including reproductive health data collected in a research context. This situation may limit the representativeness of samples in future studies and impede women's health research, which already lags far behind research on men's health (21). Apps provide women with a user-friendly design, ease of use and navigation, and options for individualization, which allows research participants to discreetly log MC symptoms in real time. In addition, apps allow researchers (and/or healthcare providers) a way to collect health data in real time, and participants a way to share reproductive health experiences, without the requirement to interact with or converse about them directly.

Finally, about one-quarter of participants in this study were not willing to share their demographic information. Of those who did provide demographic information, a majority of these women identified as White and of moderate-to-high socioeconomic status. This is consistent with participant demographics in other studies reporting on MC app or fertility app use (3,12-14). Previous research also suggests that less affluent women are less represented, as well as less inclined, to use mobile MC tracking apps because they feel that they are not suited to their needs (3). The difficulty reaching and optimally understanding women from already underrepresented groups may be exacerbated under the current legal and societal circumstances. Low participation in this study by non-White groups may also point to data privacy concerns or distrust in research participation as a result of *Roe v. Wade*, as well as overall discomfort answering questions related to the MC and MC tracking app use (22). A lack of representation also has broader negative implications for women's health research, as women from minoritized groups are often at risk for experiencing negative health outcomes with respect to treatment and autonomy over their reproductive health (11). Thus, mHealth interventions for sexual and reproductive health may not effectively inform improvements to healthcare for these communities. In addition, women from underrepresented groups may not have access to sexual and reproductive health education or services that can be provided via mobile phone.

Despite the high socioeconomic status of much of this sample, however, 36% of participants still reported that they did not want to use a MC tracking app post-Roe. Thus, although access to reproductive health care may more negatively affect women of lower socioeconomic status and education level (23), the impact of the overturning of *Roe v. Wade* extends beyond these demographic factors and seems to provoke fear in women across socioeconomic backgrounds. This points to a clear need for policy reform and the establishment of appropriate safeguards for

vulnerable health information.

Strengths, limitations, and future directions

The current study used a cross-sectional design to collect data on women's comfort with MC tracking apps used in research settings, as well as women's perceptions of non-app-based MC tracking methods. The cross-sectional survey was particularly advantageous for this line of inquiry because data were collected at a single time point, following the overturning of *Roe v. Wade* in June 2022. This cost-effective approach allowed us to ensure participant privacy and confidentiality, and collect preliminary evidence to inform future research designs. In addition, we sampled individuals who may be directly affected by this recent Supreme Court decision in a timely manner.

Limitations of this study are worth noting. First, selection bias may have resulted from our recruitment methods, and it is likely that a majority of this sample was located in the northeastern U.S. Participants were not asked what state or area they lived in, or the status of their state's reproductive laws at the time of participation. As noted, this was a short survey about sensitive topics and our goal was to limit any potential deterrents to participation (by avoiding any perception that we could identify who or where they were). However, it is likely that rates of concerns about MC tracking apps would be strongly moderated by the present (or near future) likelihood of MC data being used against the respondent, and implications for research, practice, and policy would be clearer with location information. Also, to keep the survey brief, MC tracking app name and/or company was not included as a survey question. It is unclear what apps were used by participants enrolled in this study. As certain apps and companies may have different rules and regulations with respect to data sharing policies, this may influence our intended outcomes, and is therefore a limitation of the current study.

Similarly, pre-existing concerns about (or negative experiences with) women's reproductive healthcare and/or MC apps would affect one's willingness to participate in this study, or to provide honest responses. All respondents had the option to skip any question they did not feel comfortable answering, which led to considerable rates of missing data. Although this is useful information and is not uncommon, an optimal approach would be to include a "decline to answer" or "prefer not to answer" option, to confirm that participants consciously made the choice not to answer (*vs.* random item skipping). It is possible that our survey item assessing reconsideration of MC app use "as a result of current events in the U.S." meant something different to those who were using an app prior to the overturning of *Roe v. Wade* and those who were not. Open-ended responses allowed us further insight into the extent to which recent political events influenced that decision, however, the survey item assessing reconsideration may have been better suited for only current app MC app users. Optimal methods would leave out a vague reference to "current events" and allow respondents to indicate the source(s) of any concerns.

In a similar vein, the generalizability of the present findings is not clear. Recruitment materials specified that we sought "women", which may have precluded menstruating people who do not identify as women from participating (e.g., those who identify as nonbinary or trans). Given the low rates of these identities in the U.S. population (24), we expected those who identify as cisgender women to make up the large majority of interested individuals. However, rates of gender identities other than woman and man are increasing, particularly among younger adults (25), and the perspectives of those who identify with these groups are critical to informing conclusions and next steps that address the needs of a diverse population post-Roe. Future research in this area should use broader inclusion criteria and assess gender identity.

Additionally, we focused on the attitudes and perceptions of those who had experience using MC tracking apps, *vs.* including those who may be willing to begin use; a broader perspective on potential concerns will be important in future studies that use mHealth technologies to understand MC experiences. Finally, one aim of this study was to understand who would respond and provide their demographic information. As in many other research areas, we saw low participation by women from racial and ethnic minority groups in this study (3,11,23,24), with a majority of participants identifying as White and highly educated. This may be a result of snowball and convenience sampling, and only highlights the critical need for better outreach to groups that are underrepresented in women's health research.

Conclusions

Mobile apps may provide insight into women's MC experiences by capturing time-sensitive data in the natural environment (i.e., without interpersonal disclosure to a member of a research team). Findings from the present study show that in the 3 months after the 2022 U.S.

Supreme Court decision that allows states to restrict access to women's reproductive healthcare, many women were concerned about MC apps for personal use as well as for use in the context of research participation. Thus overall, despite the availability and awareness of MC tracking apps, women's comfort with this technology is fairly low. Women's needs for app-based MC tracking may have changed in recent years; thus, additional information is critically needed to establish criteria and protections for use of health-related mobile apps. Further work is necessary to determine whether additional protections can increase women's willingness to participate in research that is essential to understanding their health experiences, which can inform improvements to healthcare and related interventions for women.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://mhealth.amegroups.com/article/view/10.21037/mhealth-23-31/rc

Data Sharing Statement: Available at https://mhealth.amegroups.com/article/view/10.21037/mhealth-23-31/dss

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://mhealth.amegroups.com/article/view/10.21037/mhealth-23-31/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was approved by the Rowan University Institutional Review Board (No. PRO-2022-203). The informed consent was obtained from all individual participants. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

References

1. Brantelid IE, Nilvér H, Alehagen S. Menstruation during a lifespan: A qualitative study of women's experiences. Health Care Women Int 2014;35:600-16.
2. Johnston-Robledo I, Chrisler JC. The Menstrual Mark: Menstruation as Social Stigma. In: Bobel C, Winkler IT, Fahs B, et al. editors. The Palgrave Handbook of Critical Menstruation Studies. Singapore: Palgrave Macmillan; 2020: Chapter 17.
3. Epstein DA, Lee NB, Kang JH, et al. Examining Menstrual Tracking to Inform the Design of Personal Informatics Tools. Proc SIGCHI Conf Hum Factor Comput Syst 2017;2017:6876-88.
4. Levy J, Romo-Avilés N. "A good little tool to get to know yourself a bit better": a qualitative study on users' experiences of app-supported menstrual tracking in Europe. BMC Public Health 2019;19:1213.
5. Bull JR, Rowland SP, Scherwitzl EB, et al. Real-world menstrual cycle characteristics of more than 600,000 menstrual cycles. NPJ Digit Med 2019;2:83.
6. Supreme Court of the United States. Dobbs v. Jackson Women's Health Organization. 2022 [cited 2023 August 8]. Available online: https://www.supremecourt.gov/opinions/21pdf/19-1392_6j37.pdf
7. Kim J. Data privacy concerns make the post-Roe era uncharted territory. 2022 [cited 2023 May 26]. Available online: https://www.npr.org/2022/07/02/1109565803/data-privacy-abortion-roe-apps
8. Duff-Brown B. Protecting Reproductive Health Information after Fall of Roe v. Wade. Stanford: Stanford University; 2022 [cited 2023 May 26]. Available online: https://fsi.stanford.edu/news/protecting-privacy-reproductive-health-information-after-fall-roe-v-wade
9. Garamvolgyi F. Why US women are deleting their period tracking apps. 2022 [cited 2023 May 26]. Available online:

https://www.theguardian.com/world/2022/jun/28/why-us-woman-are-deleting-their-period-tracking-apps
10. Gambier-Ross K, McLernon DJ, Morgan HM. A mixed methods exploratory study of women's relationships with and uses of fertility tracking apps. Digit Health 2018;4:2055207618785077.
11. Sutton MY, Anachebe NF, Lee R, et al. Racial and Ethnic Disparities in Reproductive Health Services and Outcomes, 2020. Obstet Gynecol 2021;137:225-33.
12. Earle S, Marston HR, Hadley R, et al. Use of menstruation and fertility app trackers: a scoping review of the evidence. BMJ Sex Reprod Health 2021;47:90-101.
13. Karasneh RA, Al-Azzam SI, Alzoubi KH, et al. Smartphone Applications for Period Tracking: Rating and Behavioral Change among Women Users. Obstet Gynecol Int 2020;2020:2192387.
14. Korn J, Duffy C. Search histories, location data, text messages: How personal data could be used to enforce anti-abortion laws. 2022 [cited 17 May 2023]. Available online: https://www.cnn.com/2022/06/24/tech/abortion-laws-data-privacy/index.html
15. Fitbit. Fitbit Private Policy. 2022 [cited 2023 May 26]. Available online: https://www.fitbit.com/global/us/legal/privacy-policy
16. Riley AH, Slifer L, Hughes J, et al. Results from a literature review of menstruation-related restrictions in the United States and Canada. Sex Reprod Healthc 2020;25:100537.
17. Lee J. Bodies at menarche: Stories of shame, concealment, and sexual maturation. Sex Roles 2009;60:615-27.
18. do Amaral MC, Hardy E, Hebling EM. Menarche among Brazilian women: memories of experiences. Midwifery 2011;27:203-8.
19. Marvan ML, Trujillo P. Menstrual socialization, beliefs, and attitudes concerning menstruation in rural and urban Mexican women. Health Care Women Int 2010;31:53-67.
20. O'Flynn N. Menstrual symptoms: the importance of social factors in women's experiences. Br J Gen Pract 2006;56:950-7. Erratum in: Br J Gen Pract 2007;57:156.
21. Kent JA, Patel V, Varela NA. Gender disparities in health care. Mt Sinai J Med 2012;79:555-9.
22. George S, Duran N, Norris K. A systematic review of barriers and facilitators to minority research participation among African Americans, Latinos, Asian Americans, and Pacific Islanders. Am J Public Health 2014;104:e16-31.
23. Zimmerman MS. Information Poverty and Reproductive Healthcare: Assessing the Reasons for Inequity between Income Groups. Soc Work Public Health 2017;32:210-21.
24. United States Census Bureau. Sexual orientation and gender identity in the household pulse survey. 2021 [cited 2023 May 26]. Available online: https://www.census.gov/library/visualizations/interactive/sexual-orientation-and-gender-identity.html
25. Brown A. About 5% of young adults in the U.S. say their gender is different from their sex assigned at birth. 2022 [cited 2023 May 26]. Available online: https://www.pewresearch.org/short-reads/2022/06/07/about-5-of-young-adults-in-the-u-s-say-their-gender-is-different-from-their-sex-assigned-at-birth/

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