

Preventing Pregnancy in Kenya Through Distribution and Use of the CycleBeads Mobile Application

CONTEXT: Given the proportion of Kenyan women not using hormonal contraceptives, the country appears to have a substantial need for a modern, natural family planning option. The CycleBeads® mobile phone application (app), a digital platform for the Standard Days Method® of family planning, could help address this issue.

METHODS: After the CycleBeads app was promoted in Kenya in May–June 2015, a three-month pilot study was conducted to collect quantitative and qualitative data from 185 female app users. Chi-square testing, binary logistic regression and thematic content analysis were used to assess whether the app brought new users to family planning, to understand users' experiences and to assess how user experiences vary by distribution channel.

RESULTS: Participants learned about the app through nongovernmental organizations (17%), via digital media (33%) or from family or friends (50%). Most used the app to track their periods (54%) or prevent pregnancy (37%); a few used it to plan a pregnancy (7%) or for other reasons (2%). The main reason for choosing the Standard Days Method was fear of side effects from hormonal methods (64%). The majority of women found the app and method easy to use (53%). Among those preventing pregnancy, 42% had never before used a method. By midline, all participants knew when fertile days occurred, and most (97%) knew the method's cycle-length requirements. Women reported high rates of condom use (88%), abstinence (68%) and withdrawal (46%) on fertile days.

CONCLUSION: Offering the CycleBeads app to support women in use of the Standard Days Method may expand family planning options, reduce unmet need and make family planning more widely available. *International Perspectives on Sexual and Reproductive Health*, 2017, 43(3):131–141, <https://doi.org/10.1363/43e4617>

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Given the proliferation of mobile phones in developing countries,¹ and corresponding evidence that mobile health (mHealth) can offer opportunities for transformative outcomes in family planning,² expanding family planning options for women through mobile phones has the potential to significantly reduce unmet need, and make family planning available to millions of women. Moreover, early adopters of mobile and digital technology tend to be of reproductive age (ages 15–44),¹ so mobile tools are positioned to directly reach the population in greatest need of family planning information and options.

Kenya has a large and growing telecommunications market with high levels of smartphone use. In 2015, more than 88% of the population had a mobile phone,³ and 58% of all phones sold in Kenya were smartphones.⁴ Both phone- and computer-based digital technologies have been used successfully in Kenya to provide health-related information directly to users across a range of topics, target groups and strategies. Mobile phone applications (apps) have been associated with positive health outcomes in Kenya for patients going through treatment for tuberculosis⁵ and HIV.⁶ They have also been used to improve children's health (through text reminders to mothers about child vaccinations⁷ and infant HIV services⁸) and to increase young people's family planning knowledge.⁹

With a population of more than 40 million people, Kenya has a substantial need for family planning options. Pills, injectables, IUDs, implants and male condoms are available at both public and private facilities,¹⁰ but 18% of married women who want to avoid pregnancy are not currently using a method of family planning.³ Fear of side effects (17%) and health concerns (12%) were the top reasons women in Kenya did not intend to use family planning in the future.¹¹ Although contraceptive prevalence is higher in urban areas than in other areas, national surveys show that even women in higher income quintiles are not using modern methods consistently and rely on traditional methods instead.³ Dissatisfaction with current methods is also a problem: Thirty-one percent of family planning users in Kenya discontinue use of a method within the first 12 months. Their main reasons for discontinuation are side effects and health concerns (29%).¹¹ The availability of a modern, natural method of family planning in Kenya could help address the primary reasons for nonuse and discontinuation.

The Standard Days Method® and CycleBeads® App

The Standard Days Method, a fertility-awareness method of family planning that identifies days 8 through 19 of a woman's menstrual cycle as fertile days, has been shown in pilot projects to be acceptable in Kenya.^{12–14} Although

it is currently a very limited part of Kenya's method mix, if it were available on a larger scale, the method could help many couples prevent unplanned pregnancies. The Standard Days Method, developed by the Institute for Reproductive Health (IRH) at Georgetown University with support from the U.S. Agency for International Development (USAID), is typically used with CycleBeads, a color-coded string of beads representing a woman's menstrual cycle. CycleBeads help women track their cycles and know when they are fertile. To be eligible to use the Standard Days Method, a woman must have regular menstrual cycles that are between 26 and 32 days long. The Standard Days Method, when used with CycleBeads, has been shown to be more than 95% effective in preventing pregnancy with correct use, and 88% effective with typical use,¹⁵ and is recognized as a modern method by USAID¹⁶ and the World Health Organization.¹⁷ Given its ease of use and lack of side effects, the Standard Days Method appeals particularly to couples who are not using any method, those who are relying on traditional methods and those who are dissatisfied with their current method.¹⁸⁻²⁰ Anecdotal data suggest that lack of access to CycleBeads is a barrier to wider use of the Standard Days Method in many settings, including Kenya.

The CycleBeads app, a digital platform to support women using the Standard Days Method, is the first mHealth app marketed in Kenya to offer an evidence-based family planning method exclusively via mobile phone. The CycleBeads app was developed by Cycle Technologies to allow women who use the Standard Days Method to use their smartphones to track their menstrual cycles and to plan or prevent pregnancy through a simple app that is small enough to facilitate easy downloading in developing countries.

To use the CycleBeads app, a woman downloads it for free from the Google Play Store (for Android phones) or iTunes (for Apple products) and answers the eligibility screening questions; if eligible, she then enters the start date of her most recent period. Using the woman's period start date, the app calculates what day she is on in her current cycle and whether she is on a day on which pregnancy is possible or unlikely. According to the woman's preference, this information is displayed on her phone screen either as a calendar or as a virtual representation of physical CycleBeads, with white beads indicating fertile days (when pregnancy is possible) and brown beads indicating safe days. The woman receives alerts to let her know when she is on a fertile day and when she is about to start her next period, and to remind her to input her next period start date. She is also notified if the length of her cycle is outside the required range. On cycle days eight through 19, when pregnancy is possible, the woman is instructed to either abstain from sexual activity or use a condom if her goal is to prevent pregnancy. The app includes detailed "Directions" and "About" pages, which state that efficacy trials found the method to be more than 95% effective when used correctly (similar to other user-dependent

family planning methods), and that use of the Standard Days Method does not protect against HIV or other STIs.

The app determines method eligibility through two screening questions: "Do you get your periods monthly (every 26–32 days)?" and "Have you been pregnant or used hormonal contraception in the past 3 months?" (Appendix Figure 1). Women who are unsure of their cycle length are encouraged to use the app to track their cycles before using it to prevent pregnancy. Women who have recently been pregnant, used a hormonal method of birth control or used emergency contraception need to wait until their cycles are within the required range before using the Standard Days Method to prevent pregnancy. Women who do not meet the criteria are notified that the Standard Days Method is not an appropriate family planning method for them and are advised not to use the app to prevent pregnancy.

This study aims to assess whether the CycleBeads app brings new users to family planning, to understand the experience of its users in Kenya and to determine how user experience varies by the channel through which women learned about the app.

METHODS

Distribution of the CycleBeads App

During a four-week period in May and June 2015, the CycleBeads app was actively promoted in and around Nairobi, Kenya, through two primary distribution channels: nongovernmental organization outreach and digital media. A local nongovernmental organization partner, Afri-Afya, held five half-day community meetings that provided general information on reproductive health and family planning methods, and specific, detailed information on the Standard Days Method and how to download and use the CycleBeads app. The meetings, paid for by IRH, cost approximately US\$2,000 each, and included lectures, app demonstrations and hands-on assistance. Over 300 women and men attended one of the meetings; two of the meetings were held in large central locations and three were in smaller neighborhoods.

During the same time period, Cycle Technologies, the commercial developer and distributor of the CycleBeads app, conducted a digital marketing campaign targeting women of reproductive age in Nairobi; the campaign consisted primarily of Facebook advertising, with supporting social media and website activities. Facebook ads featured women and couples successfully using the CycleBeads app, and were specifically targeted to women aged 18–39* who were accessing Facebook through their Android phones, the most popular type of smartphone in Kenya. Cycle Technologies spent US\$1,015 on Facebook ads promoting the CycleBeads app over the distribution period. In addition, many women reported hearing about the CycleBeads app through a friend or family member; this

*The age range was 18–39 because of institutional review board restrictions on working with minors, and because Demographic and Health Surveys show very low unmet need for women older than 39.

was added as a third distribution channel during analysis. Women who downloaded the app from a Facebook ad or who heard about it from friends or family had the option of reading the information provided in the CycleBeads app to get started.

Research Study

A pilot study collected quantitative and qualitative data from CycleBeads app users in Kenya at three time points between May and September 2015. All CycleBeads app users in Kenya aged 18 or older who downloaded the app during the distribution period were eligible, and received a pop-up notification in the app within two weeks of downloading it, asking if they would like to participate in a study. Interested users provided their phone number through the app in response to the notification, and were called by researchers to schedule an interview. The informed consent and all interviews were conducted in person, typically at the user's residence. Interviews were conducted by female data collectors who were recruited and trained by an independent research organization not affiliated with IRH or Cycle Technologies.

Overall, 185 CycleBeads app users were enrolled in the study. Seven percent of CycleBeads app users who received a pop-up notification were willing to participate in the study. The researchers attempted to contact every app user who provided contact information, but many were unreachable. Original sample size estimates were up to 400 women, with the expectation that the sample size could vary greatly depending on interest of users across each of the distribution channels. We aimed for 10–12 women from each distribution channel for the in-depth interviews. In past and similar work on the CycleBeads app, this size was sufficient to provide a range of insights across a variety of participant experiences, and large enough to reach saturation on topics of interest to the study. Data were collected at baseline (within 1–2 weeks of downloading the CycleBeads app), midline (approximately 5–7 weeks post-download) and endline (approximately three months post-download). Structured quantitative interviews were conducted with all study participants at all three time points, and in-depth qualitative interviews were conducted with a randomly selected subset of 28 study participants immediately following quantitative data collection (the same subset at each time point). Study participants who discontinued using the CycleBeads app at midline or endline were interviewed about their reasons for discontinuation and were not contacted again. All interviews were conducted in the language of the study participant's choice, either English or Swahili.

Quantitative Interviews

Structured interviews were used to collect quantitative data through surveys consisting of 20–35 closed-ended questions with predetermined response options designed to take 15–30 minutes. The baseline structured interview

included questions on how users learned about the method and the app (distribution channel) and how they intended to use the app (to track cycles or to plan or prevent pregnancy), as well as on their previous family planning use, their experience downloading the app, and their initial understanding of the CycleBeads app and how to use it after less than two weeks of use. In addition, at baseline, the women were asked about their age, marital and employment status, and education and income level.

Participants were contacted again at midline and endline for additional structured interviews related to ongoing understanding of, correct use of, and satisfaction with the app and the method; they were also asked whether they had discussed the Standard Days Method or the app with their current partner. Correct use of the Standard Days Method was assessed through questions about the management of fertile days (plans at baseline, and reports of actual use at midline and endline) and by whether the woman had entered a second period start date. Study participants with misinformation about how to use the Standard Days Method received corrections from the interviewer at the conclusion of each interview. The interviewers were given a script with correct information on when fertile days occur, cycle-length requirements, use of emergency contraceptive pills on fertile days and eligibility to use the method following recent use of hormonal contraception, as well as information to dispel the belief that the method (and thus, use of the app) protects against STIs and HIV.

Data were collected by the interviewers on paper versions of the survey instruments and entered manually in Kenya. Data cleaning and descriptive analyses were conducted at IRH headquarters in Washington, DC, using SPSS 22. All descriptive analyses were summarized using frequencies and percentages, or means and ranges, as appropriate. Chi-square tests were used to test for associations in responses by age, education, distribution channel and other relevant variables. If a significant association with age or education was present, a binary logistic regression model was used to test the association between distribution channel and the outcome variable while other variables were controlled for.

Qualitative Interviews

In-depth interviews collected qualitative data through conversations of approximately one hour. Three interview guides (baseline, midline/endline and discontinued users) were designed to supplement the structured quantitative interviews and elicit in-depth insights into how users had heard about the CycleBeads app and had decided to use it, as well as how they use both the Standard Days Method and the app, communicate with their partners and manage fertile days. Women who discontinued use of the app were asked to discuss their reasons for discontinuation and any problems they experienced. All interviews were audio recorded, transcribed and translated into English, if necessary.

Qualitative thematic content analysis techniques were used to analyze the data, following a process of reading, coding, data display and reduction.²¹ All transcripts from the in-depth interviews were read and initially coded on the basis of questions in the interview guide and emerging themes using the qualitative data analysis software ATLAS.ti. Primary coding reports were extracted and further analyzed. Emergent sub-themes were codified and applied to the data in coding reports. A framework was developed to summarize findings within each broad theme, to examine how themes and participant experiences changed over time, and to analyze differences in respondents by distribution channel and purpose of use. Quotes illustrative of key findings are presented.

TABLE 1. Selected characteristics of women participating in an mHealth study on the use of the Standard Days Method and the CycleBeads app, by distribution channel, Nairobi, Kenya, 2015

Characteristic	All (N=185)	Channel		
		NGO outreach (N=31)	Digital media (N=61)	Friends/family (N=93)
Purpose of using the app***				
Prevent pregnancy	37.3	9.7	15.1	12.4
Plan pregnancy	7.0	1.6	3.2	2.2
Track cycle	54.1	5.4	14.1	34.6
Other	1.6	0.0	0.5	1.1
Age***				
18–25	69.7	9.2	17.3	43.2
26–35	23.8	4.9	11.9	7.0
36–45	6.5	2.7	3.8	0.0
Marital status***				
Single	33.5	5.4	9.2	18.9
In a relationship	47.0	7.0	11.4	28.6
Married	18.4	3.2	12.4	2.7
Separated	0.5	0.5	0.0	0.0
Widowed	0.5	0.5	0.0	0.0
Employment status				
Not employed	9.2	1.1	1.6	6.5
Student	45.4	3.2	10.8	31.4
Employed part-time	5.4	1.6	0.0	3.8
Employed in informal sector	7.6	2.2	2.7	2.7
Employed in formal sector	18.9	4.3	9.7	4.9
Self-employed	11.4	3.8	6.5	1.1
Housewife	2.2	0.5	1.6	0.0
Education**				
≤secondary	25.4	2.2	11.9	11.4
Attended/completed college	24.9	5.4	10.8	8.6
Attended/completed university/postgraduate	49.7	9.2	10.3	30.3
Income*				
≤KES 20,000	21.1	4.9	5.9	10.3
KES 20,000–50,000	21.6	3.2	9.2	9.2
KES 50,000–100,000	7.6	2.2	4.3	1.1
>KES 100,000	5.9	2.7	3.2	0.0
Don't know	15.1	1.1	2.7	11.4
Refused to answer	28.6	2.7	7.6	18.4

*Distributions by channel significantly different at $p \leq 0.05$. **Distributions by channel significantly different at $p \leq 0.01$. ***Distributions by channel significantly different at $p \leq 0.001$. Notes: Row percentages may not add to percentage in "All" column because of rounding. NGO=nongovernmental organization. KES=Kenyan shilling.

Ethical Approval

The study was approved by the Georgetown University Institutional Review Board and the Ethics and Scientific Review Committee of the African Medical and Research Foundation. Written informed consent was obtained from all study participants prior to baseline data collection, and consent was confirmed at midline and endline.

RESULTS

From May to September 2015, the CycleBeads app had 2,570 downloads in Kenya, at a cost of US\$0.47 per download. A total of 185 CycleBeads app users were enrolled in the study and participated in the baseline survey. Of these, 90% participated in a survey at midline (126 as continuing users and 40 as discontinued users), and 67% participated in a survey at endline (115 as continuing users and eight as discontinued users). During the three-month study period, 12% of study participants (22) were lost to follow-up and 26% discontinued use of the CycleBeads app (48).

Participant Demographics

Participants ranged in age from 18 to 43, with a mean age of 25 years, and all were female. Two-thirds reported being married or in a relationship (Table 1). Many were students (45%), and 50% had a university or postgraduate education. Study participants learned about the CycleBeads app through one of three distribution channels: by attending an outreach event hosted by Afri-Afya (17%); through digital media (33%), primarily Facebook and the Google Play Store; or from family or friends (50%).†

Purpose of Use

At baseline, most study participants were using the CycleBeads app because they wanted to track their periods (54%) or prevent pregnancy (37%); only a few wanted to plan a pregnancy (7%) or were testing the app and had not decided on a purpose of use (2%). Distribution channel, age and marital status were significantly associated with purpose of use (Table 2). Women using the app to prevent pregnancy were 3.7 times as likely to have learned about it at an Afri-Afya meeting as from family and friends. Also, those using the app to prevent pregnancy were more likely to be in a relationship or to be married than to be single (odds ratios, 5.8 and 9.6, respectively). Women using the app to track their cycle were more likely to be aged 18–25 than to be aged 36–45 (19.0). Those using the app to track their cycle had lower odds of having heard about the app through an Afri-Afya meeting than from family or friends (0.3), and were less likely to be married or to be in a relationship than to be single (0.1 for each). The small number of study participants using the app to plan a pregnancy did not allow for regression analyses to be performed.

†The proportion of participants who learned about the app from family or friends may be inflated because some participants said that they heard about it through a friend who had shared the information on social media.

During the study follow-up period, 29 study participants switched their purpose of use, the majority (25) during the first 45 days of app use (not shown). Switching most commonly occurred between preventing a pregnancy and tracking the menstrual cycle (13). The in-depth interviews suggest switching may have occurred because of interactions with partners or a lack of distinction among participants between tracking their cycles and preventing pregnancy. As a 21-year-old who learned about the app through friends and family stated, “I normally use it for pregnancy prevention when my partner is here, but right now I am just tracking my cycle.”

Family Planning History

Seventy-four participants used the CycleBeads app to prevent pregnancy at some point during the study. The main reasons for choosing the Standard Days Method and the app over another method of family planning were fear of side effects and the belief that the app is simple or easy to use (64% and 53%, respectively). Other reasons cited for using the method and app were the desire to get pregnant in the next year (24%), the belief that the app is effective (20%), the fact that the app is free (16%) and the desire to try something new (3%).

“I was wondering where [the app] has been all this time. It’s something that’s natural and real. It’s not complicated and doesn’t have any side effects. I was so happy.”—27 years old, learned about app from Afri-Afya

Among those using the app to prevent pregnancy, 42% had never used a family planning method before. Among the rest, male and female condoms were the method used by the greatest proportion of participants before initiating use of the CycleBeads app (42%), followed by the pill (8%), injection or withdrawal (7% for each), emergency contraception (5%) and the IUD, the implant or physical CycleBeads (3% for each); 1% reported previously using the rhythm method. Many women reported previous use of more than one method; a reclassification based on the most effective method ever used found that among those preventing pregnancy, 3% had previously relied solely on a traditional method (withdrawal, rhythm method), 43% had used other short-acting modern methods (male or female condoms, pills, Standard Days Method, emergency contraception) and 12% had used longer-acting reversible contraception (injection, IUD, implant).

Knowledge of How to Use the Method and the App

Study participants had high levels of knowledge at all time points about the CycleBeads app and how to use it to prevent pregnancy (Table 3). At midline, all 39 respondents knew when fertile days occur (as identified by the Standard Days Method), compared with 61 of 69 (88%) at baseline. At midline, 38 of 39 (97%) had knowledge of the method’s minimum cycle-length requirements, knowing that a woman’s cycle is too short to use this method if her period is less than 26 days.

TABLE 2. Odds ratios (and 95% confidence intervals) from binary logistic regression analyses assessing the associations between the purpose of using the CycleBeads app and selected characteristics

Characteristic	Purpose of using app	
	Prevent pregnancy (N=69)	Track cycles (N=100)
Distribution channel		
NGO outreach	3.7 (1.4–10.1)**	0.3 (0.1–0.8)*
Digital media	1.8 (0.8–4.3)	0.6 (0.2–1.5)
Family and friends (ref)	1.0	1.0
Age		
18–25	0.2 (0.0–1.0)	19.0 (1.8–201.4)*
26–35	0.3 (0.1–1.6)	7.0 (0.6–84.8)
36–45 (ref)	1.0	1.0
Marital status		
Single/separated/widowed (ref)	1.0	1.0
In a relationship	5.8 (2.2–15.0)***	0.1 (0.0–0.3)***
Married	9.6 (2.7–34.4)**	0.1 (0.0–0.2)***
Education		
≤secondary (ref)	1.0	1.0
Attended/completed college	2.1 (0.7–5.9)	0.3 (0.1–1.1)
Attended/completed university/postgraduate	2.0 (0.8–5.2)	0.5 (0.2–1.3)

*p<.05. **p<.01. ***p<.001. Notes: Both models included all 185 participants. NGO=nongovernmental organization. ref=reference group.

TABLE 3. Among participants seeking to prevent pregnancy, percentage with accurate knowledge and correct use of the Standard Days Method and CycleBeads app, by study time point

	Baseline (N=69) %	Midline (N=39) %	Endline (N=38) %
Knowledge			
Knew when fertile days occur (white beads/days 8–19)	88.4	100.0	na
Knew minimum cycle-length requirements (26 days)	na	97.4	na
Correct use			
Planned to abstain or use condoms on fertile days	65.2	na	na
Had abstained or used condoms on fertile days in the previous 45 days	na	59.0	63.2
Entered period start date	92.8	97.4	na

Note: na=not applicable.

The in-depth interviews support a high level of understanding among participants about how to use the app and about cycle-length requirements for the Standard Days Method.

“The concept of the beads [on the app screen] made it easy to understand. When it’s on white, [you] know you are likely to get pregnant, but on brown bead days, you know you’re safe.”—25 years old, learned about app from Afri-Afya

“They said if you [have a cycle] between 26 and 32 days then this method can work for you, and 80% of women usually lie between that.”—23 years old, learned about app from Afri-Afya

Management of Fertile Days

A variety of strategies were used on fertile days to prevent pregnancy, and many participants used more than one. Some 88% of the 41 study participants using the app because they wanted to prevent pregnancy at midline or endline reported using male condoms on fertile days at some point during follow-up (not shown). There were also high rates of abstinence (68%) and withdrawal (46%), with lower usage of female condoms (22%) and emergency contraception (12%).

The ideal strategy for managing fertile days is abstaining from sex or using a male or female condom. At baseline, 45 of 69 study participants who intended to use the app to prevent pregnancy planned to use condoms or abstain on fertile days (65%); at midline and endline, the numbers reporting having actually used that strategy on fertile days in the last 45 days were 23 of 39 (59%) and 24 of 38 (63%), respectively† (Table 3). Despite this overall consistency, strategies for managing fertile days varied over time for individual study participants. Only 42% of study participants preventing pregnancy used the ideal strategy at both midline and endline (not shown). Chi-square results found no statistically significant differences in the management of fertile days by age, education, distribution channel or knowledge of how to use the Standard Days Method.

Many study participants considered sex with withdrawal to be protected sex. Almost 40% of women who were using the app to prevent pregnancy reported using withdrawal during fertile days, but responded negatively when asked if they had had unprotected sex in the previous 45 days. A 22-year-old who learned about the app through Afri-Afya spoke about her and her partner's preferences for managing fertile days:

“Condoms are the best, but...you can't use them all the time. That is where withdrawal comes in. If it were up to me, I would go for 100% condoms.”

Within two weeks of downloading the CycleBeads app, 64 of 69 study participants using the app to prevent pregnancy had entered a period start date (93%). At midline, only one participant out of 39 had not entered her period start date.

Corrections

Study participants received few corrections for misconceptions related to knowledge or correct use of the method and the app (Table 4). At baseline, 11% of participants received a correction, primarily relating to confusion about use of the method after taking emergency contraceptive pills and the meaning of the colors in the visual image of CycleBeads. By midline, the proportion of continuing users who received a correction was 6%; by endline, that proportion was 3%.

†Differences in participant numbers between baseline, midline and endline interviews reflect discontinuation, loss to follow-up and switching purpose of use.

Partner Involvement

Most study participants communicated with their partner about their use of the CycleBeads app and about their fertile days (not shown). About half of participants (75 of 144) who had a partner said their partner was aware that they were using the CycleBeads app within two weeks after they downloaded it. By midline, 84 of 112 study participants had talked to their sexual partner about the CycleBeads app, and that proportion rose to 87 of 109 participants by endline. Purpose of use was significantly associated with partner communication. Communication was highest among participants using the app to prevent pregnancy: 89% of these participants talked with their partner about the app during the study.

Some women said that use of the CycleBeads app helped improve communication with their partner. Speaking about her partner, one woman noted:

“We don't live together and sometimes he can come or tell me to go to him and maybe those are the unsafe days and when you tell him that, he doesn't understand. He thinks I don't want to have sex with him. But after showing him this application, even he knows it's unsafe to have [unprotected] sex.”—age unknown, learned about app from Afri-Afya

Satisfaction

Study participants reported high levels of satisfaction with the Standard Days Method and the CycleBeads app. At baseline, 70% reported they were satisfied with the method and app, compared with 30% who said they were neither satisfied nor dissatisfied, and 1% who were dissatisfied. Not surprisingly, given that study participants who were not satisfied discontinued their use of the CycleBeads app or were lost to follow-up, the percentage of continuing users at midline and endline who said they were satisfied rose to 91% and 97%, respectively.

Acquiring additional knowledge from the app about their bodies and menstrual cycles was appreciated, and helped participants feel more secure about their ability to prevent pregnancy. Two participants reported:

“I enjoy using it. Personally, I feel like it's someone watching me and telling me what to do as far as my reproductive health issues are concerned.”—24 years old, learned about app from Afri-Afya

“It has helped me a lot, even the feeling of safety when [I] am having sex without protection is because I know on this day pregnancy is not likely, so I would say I have a bit more confidence than I did before. It's not like those times I would take almost 50 pregnancy tests only to find [that] it's paranoia.”—22 years old, learned about app from Afri-Afya

All study participants still using the app at midline and endline had recommended the app to someone else, primarily to other women within their social network.

“I had a friend who once used the pills, and it really affected her. So, I told her there is this [app] I use—it's very natural. I explained what the beads mean.... She

TABLE 4. Participants' issues with the Standard Days Method and CycleBeads app, the corrections provided and the proportion of the sample requiring correction, by study time point

Issue	Correction	Baseline (N=185) %	Midline (N=126) %	Endline (N=115) %
Participant recently switched from using hormonal method	If you have recently used a hormonal method, you will need to wait until you have two cycles (three periods) in a row that are in the 26–32 day range.	0.5	0.0	0.9
Use of emergency contraception	If a woman uses emergency contraception as a result of having sex on the fertile days, she should abstain or use a barrier method until her next period. She can resume using CycleBeads for her next cycle. If a woman is unable to avoid unprotected sex during the fertile days, she should consider a different method.	3.2	3.2	1.7
Confusion over meaning of the colors	White bead days are days when you can get pregnant. On brown bead days, pregnancy is not likely.	7.0	3.2	0.0
Confusion over cycle-length requirements	When using the app to prevent pregnancy, it is really important that your periods come every 26–32 days. If a woman gets her period before day 26 has passed, or before the dark brown bead, that means her cycle is too short to use this app. If she gets her period after day 32 or after the beads are over, that means her cycle is too long to use this app.	na	0.0	0.0
Participant has not entered period start date after using the app for more than five weeks	You need to enter in your period start date for this to work. This [method] is only for women who get their periods every 26–32 days. If you haven't gotten your period yet, you are probably not qualified to use it for preventing pregnancy.	na	0.8	0.0
CycleBeads protects against STIs and HIV	CycleBeads cannot be used [to protect against STIs or HIV]. Only consistent and correct condom use can protect against STIs and HIV.	0.0	0.0	0.0
Percentage of participants receiving ≥1 correction		10.8	6.3	2.6

Notes: The responses in the table were taken from the script used by the data collectors and edited for length. na=not applicable.

liked it and started using it.”—21 years old, learned about app from digital media

Among the 48 study participants who discontinued using the app before the midline or endline of the study for any purpose, satisfaction was lower at the time of their final interview than it was for continuing app users: 45% said they were satisfied, 43% said they were neither satisfied nor dissatisfied and 13% said they were dissatisfied. Among those who discontinued use of the app, 62% said they thought they would use the app in the future, and 72% had recommended the app to someone else.

Discontinuation

During the study period, 22 study participants (12%) were lost to follow-up, and 48 discontinued using the CycleBeads app for any reason (26%). At the time of discontinuation, 17 were using the app to prevent pregnancy, four were using it to plan a pregnancy and 27 were tracking their cycles. Discontinuation and loss to follow-up were significantly associated with education ($p=.006$) and with knowledge of when fertile days occur ($p=.003$). Of those who discontinued use or who were lost to follow-up, 54% had at least a university degree and 33% had a high school education, compared with 47% and 20% of continuing users, respectively. Seventeen percent of participants who discontinued use or who were lost to follow-up had incorrect knowledge of when fertile days occur at baseline, compared with 4% of continuing users. Discontinuation and

loss to follow-up were not associated with age, distribution channel, purpose of use, satisfaction, partner's satisfaction, plans to continue using the app, ease of download or experience of technical difficulties using the app.

Overall, 28 study participants stopped using the CycleBeads app to prevent pregnancy during the study period; 11 switched to using the app for another purpose and 17 discontinued use of the app entirely (not shown). The primary reasons for discontinuation were wanting to become pregnant (43%), having cycles that were out of range or irregular (21%), or losing or replacing a phone (11%). Of the 15 study participants who discontinued use of the CycleBeads app to prevent pregnancy and still wanted to prevent pregnancy, only four reported using another family planning method (3) or planning to use another method (1) by the time of the interview.

During the study, one participant using the app to prevent pregnancy had an unplanned pregnancy. Though she demonstrated correct knowledge of how to use the app at baseline, she attributed the pregnancy to her cycles being too short for her to use the method. The 28-year-old participant, who learned of the app through Afri-Afya, said, “Everything was in order, but I think my cycle was too short, so in between there, something happened.”

DISCUSSION

This study allows us to answer basic questions about CycleBeads app users, users' understanding of and

experience with the app, and the potential for app distribution channels. It shows that the Standard Days Method supported by the CycleBeads app can be a valuable addition to the family planning method mix in Kenya because it is addressing an unmet need, it is understood and used correctly by most users, and it can be distributed at very low cost directly to users. Our findings that younger, single women were using the app to track their cycles, and that many women switched between using the app to track their cycles and using it to prevent pregnancy, indicate that the CycleBeads app may play an interesting role in the family planning method mix. Women can use the app to learn more about their fertility by tracking their cycles, and then switch to using it to prevent pregnancy (or to another method of family planning) when the need arises.

Many new users were brought to family planning by the CycleBeads app; over 40% of our study sample had never used any method of family planning before. Previous research has shown that in addition to attracting new users, the Standard Days Method brings discontinued users back to family planning, many of whom had discontinued their previous method due to reported side effects.^{18,22-24} Indeed, more than 60% of our sample chose to use the Standard Days Method and the CycleBeads app because of fear of side effects.

CycleBeads app users were able to understand how to use the app correctly to prevent pregnancy, regardless of whether they downloaded the app from a Facebook advertisement and read the information provided to get started, or learned about the app through more intensive meetings led by trained nongovernmental organization workers. Few differences were observed by distribution channel. In our study, study participants were provided with corrections if they had incorrect knowledge or were using the method incorrectly, and knowledge was found to increase over time. It is unknown whether the same increase in knowledge over time occurred in the general population. However, the high knowledge at baseline, when most women had had the app for fewer than two weeks, suggests the app is easy for women in Kenya to understand.

Approximately 60% of our sample using the CycleBeads app to prevent pregnancy indicated ideal use of the method, by abstaining from sex or using a condom on fertile days. The use of withdrawal (46%) and emergency contraceptive pills (12%) is a concern. Withdrawal was viewed by study participants as a method of protected sexual intercourse. Use of emergency contraceptive pills is a reasonable and appropriate strategy for women who have unprotected intercourse on a fertile day. However, use of emergency contraceptive pills affects cycle length and timing of ovulation, thus reducing both eligibility to use the app and its effectiveness. This incomplete understanding of effective strategies for managing fertile days, or inability to adhere to them, may complicate women's correct and continuing use. Additional messaging may be required to encourage the use of more effective methods such as

condoms or abstinence on fertile days, or to encourage women who cannot comply to use a different method.

Similar research was conducted in India to compare results across different cultural contexts, and despite differences from Kenya in terms of demographics, purpose of use and the role of men, the CycleBeads app was understood and used correctly by women in India who downloaded the app after viewing Facebook advertisements. After it was demonstrated that the CycleBeads app can be distributed easily and inexpensively through digital marketing campaigns, marketing of the app was expanded, and data are currently being collected through in-app monitoring on user demographics; behavioral characteristics; and app use in Kenya, Ghana, India, Nigeria and Jordan. Further research and monitoring efforts are exploring whether women who discontinue using the CycleBeads app transition to other family planning methods.

Limitations

We identified several limitations to this study. The first is that we did not conduct a parallel study with physical CycleBeads or with another family planning method to compare experience, understanding and distribution. Further, all data were self-reported. Social desirability bias may have had an impact on the reporting of some questions, particularly correct management of fertile days, satisfaction with the app and partner communication. In addition, our sample was not randomly selected. Eligible CycleBeads app users who received a pop-up message in the app could express their interest in participating in a study by providing a contact phone number. Women interested in the study may not be representative of all CycleBeads app users in Kenya. Also, loss to follow-up, and to a lesser degree discontinuation, make it difficult to interpret some findings. Although we found high levels of knowledge, satisfaction and partner communication, as well as few corrections provided by interviewers, it is possible that these results are skewed, because participants with low knowledge and those who were dissatisfied with the app or who had difficulty communicating with their partner about the Standard Days Method or the app may have dropped out of the study or stopped using the app. We were able to interview many discontinued users, but for users lost to follow-up, we have only the data reported in the baseline interview. In addition, not all questions on knowledge or correct use were asked at each time point, making it difficult to assess change over time. The high knowledge at midline suggests knowledge would have remained high at endline; this information would have further contributed to the evidence base. And finally, it is a limitation of our survey design that we do not have more information on previous family planning use, or its level of consistency. More information about the previous family planning history of app users would further strengthen our understanding of the value of offering the CycleBeads app as part of the method mix.

Conclusion

With no differences in knowledge and correct use of the app by distribution channel, it appears that the CycleBeads app can be distributed easily and inexpensively through digital marketing campaigns to women in need of a natural way to prevent pregnancy. More than 2,115 of the CycleBeads app downloads in Kenya were attributable to Facebook advertising, at a low cost of US\$0.47 per download. Through digital marketing, the CycleBeads app has the potential to reach women outside of the health system with a way to use a family planning method directly on their smartphone.

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RESUMEN

Contexto: Dada la proporción de mujeres kenianas que no usan anticonceptivos hormonales, el país parece tener una necesidad sustancial de opciones de planificación familiar moderna y natural. La aplicación (app) para teléfonos móviles CycleBeads®, una plataforma digital para el Método de Días Fijos® de planificación familiar, podría ayudar a abordar este tema.

Métodos: Después de haber promovido la app CycleBeads en Kenia entre mayo y junio de 2015, se condujo un estudio piloto de tres meses para recolectar datos cuantitativos y cualitativos de 185 usuarias de la app. Se usaron pruebas de chi cuadrado, regresión logística binaria y análisis de contenido temático para determinar si la app atrajo a nuevas usuarias a la planificación familiar, comprender las experiencias de las usuarias y analizar cómo las experiencias de las usuarias varían según el canal de distribución.

Resultados: Las participantes se enteraron de la existencia de la app a través de organizaciones no gubernamentales (17%), vía medios digitales (33%) y por familiares o amigos (50%). La mayoría usó la app para llevar un registro de sus períodos menstruales (54%) o para evitar el embarazo (37%); algunas la usaron para planificar un embarazo (7%) o por otras razones (2%). La principal razón para elegir el Método de Días Fijos fue el temor a los efectos secundarios de los métodos

hormonales (64%). La mayoría de las mujeres encontró que la app y el método eran fáciles de usar (53%). Entre las que estaban evitando el embarazo, el 42% nunca había usado un método. A la mitad del estudio, todas las participantes sabían cuándo ocurrían los días fértiles, y la mayoría (97%) conocía los requerimientos relativos a la longitud del ciclo del método. Las mujeres reportaron altas tasas de uso de condón (88%), abstinencia (68%) y retiro (46%) en los días fértiles.

Conclusión: Ofrecer la app CycleBeads para apoyar a las mujeres en el uso del Método de Días Fijos puede expandir las opciones de planificación familiar, reducir la necesidad insatisfecha y hacer que la planificación familiar esté disponible de forma más amplia.

RÉSUMÉ

Contexte: Au Kenya, la proportion de femmes qui ne pratiquent pas la contraception hormonale donne à penser qu'il existe dans le pays un besoin considérable d'une option de planification familiale naturelle moderne. L'application pour téléphone mobile iCycleBeads™ (appli), une plateforme numérique pour la Méthode des jours fixes®, pourrait être utile à cette fin.

Méthodes: Après la promotion de l'appli CycleBeads au Kenya en mai-juin 2015, une étude pilote de trois mois a procédé à la collecte de données quantitatives et qualitatives auprès de 185 utilisatrices. L'examen par tests chi carré, régression logistique binaire et analyse de contenu thématique a servi à évaluer si l'appli avait amené de nouvelles utilisatrices à la planification familiale, à comprendre l'expérience des utilisatrices et à évaluer la variation de cette expérience en fonction du canal de distribution.

Résultats: Les participantes ont découvert l'appli par l'intermédiaire d'organisations non gouvernementales (17%), de médias numériques (33%) ou de membres de leur famille ou d'amies (50%). La plupart ont utilisé l'appli pour suivre leurs

règles (54%) ou pour éviter une grossesse (37%); quelques-unes pour planifier une grossesse (7%) ou pour d'autres raisons (2%). La raison principale du choix de la Méthode des jours fixes s'est avérée la peur des effets secondaires des méthodes hormonales (64%). Les femmes ont, en majorité, trouvé l'appli et la méthode faciles à utiliser (53%). Parmi celles qui cherchaient à éviter une grossesse, 42% n'avaient encore jamais pratiqué de méthode. À la ligne médiane, toutes les participantes connaissaient le moment des jours féconds et la plupart (97%) avaient connaissance des critères de la méthode concernant la longueur du cycle. Les femmes ont déclaré des taux élevés de recours au préservatif (88%), à l'abstinence (68%) et au retrait (46%) durant leurs jours féconds.

Conclusion: Proposer l'appli CycleBeads aux femmes pour les aider à utiliser la Méthode des jours fixes peut élargir les options de planification familiale, réduire les besoins non satisfaits et rendre la planification plus largement disponible.

Acknowledgments

This study was funded by grant number OPP108445 from the Bill and Melinda Gates Foundation under the A3 Project: Expanding Family Planning Access, Availability and Awareness. Victoria Jennings is an inventor of the patented CycleBeads technology, owned by Georgetown University, that is the subject of this research and is related to the owner of Cycle Technologies, which has an exclusive license from Georgetown University for commercialization of the technology. She has no financial relationship to and receives no income from Cycle Technologies. Neither she nor the other authors receive, nor will they receive, royalties related to the licensed technology.

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Appendix Figure 1. The CycleBeads App

