Original Paper

Evaluation of an mHealth Intervention in Underserved Areas of Colombia for the Education of Women in Fertile, Pregnancy, and Postpartum Stages: Usability and Satisfaction Assessment

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Abstract

Background: Maternal and reproductive health inequities persist in low- and middle-income countries, particularly in underserved regions with limited access to health education. The Urabá subregion in Antioquia, Colombia, is characterized by high levels of unmet basic needs and limited access to health information, making it an opportune setting for digital health interventions.

Objective: This pilot study aimed to evaluate the usability and user satisfaction of HADA Educación, a mobile app designed to provide reproductive health education to women of reproductive age, during pregnancy, and in the postpartum period.

Methods: A prospective observational pilot study was conducted between May and November 2024 among women aged 18 to 49 years. Participants received tablets preloaded with the app through which they accessed content tailored to their reproductive stage for six months or until they completed the learning pathway, whichever occurred first. Usability was assessed using the validated Spanish version of the System Usability Scale (SUS) and satisfaction with a study-specific 10-item Likert-scale survey (SSSQ). Given the pilot design, analyses were descriptive and estimation-based rather than confirmatory: scores are summarized with medians and IQRs, and associations between usability, satisfaction, and sociodemographic characteristics are quantified with rank-based correlation coefficients and effect sizes reported with 95% CIs.

Results: Of 89 enrolled participants, 77 (86.5%) completed the postintervention assessment. The median SUS score was 80.0 (IQR 75.0-92.5), and the median satisfaction score was 4.5/5 (IQR 4.2-4.6). Usability showed a weak correlation with overall satisfaction (Spearman ϱ=0.30, 95% CI 0.08-0.49). Effect sizes for usability and satisfaction across sociodemographic subgroups (reproductive stage, education, socioeconomic stratum, municipality) were small ($\varepsilon^2 \leq 0.07$ in all comparisons).

Conclusions: This pilot study found favorable usability and user satisfaction among participants who completed the postintervention assessment. The observed completion rate provides preliminary information for planning future feasibility and effectiveness studies but does not establish the feasibility, acceptability, or generalizability of the delivery model. Subgroup findings were exploratory and should be interpreted cautiously given the small, nonprobability sample. Larger and more representative studies incorporating educational and health outcomes are needed to assess the intervention's effectiveness and inform any future scale-up.

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Keywords: mHealth; mobile app; usability; user satisfaction; reproductive health; health education

Introduction

Considerable progress has been made in reducing maternal and infant mortality worldwide; however, substantial inequalities persist both between and within countries [1]. Each year, more than 4.5 million women and newborns die during pregnancy, childbirth, or the first weeks of the child's life, with the vast majority of these largely preventable deaths occurring in low- and middle-income countries [1-3]. These persistent disparities highlight the need for scalable strategies that improve access to timely, reliable, and contextually appropriate reproductive and maternal health education, particularly in underserved regions.

Mobile health (mHealth) apps have emerged as a promising approach to address gaps in access to health information and services. Evidence suggests that well-designed mHealth tools can support wellness management, behavior change, health data collection, self-management, and patient engagement while also reducing health care costs and improving adherence to recommended practices [4-9]. In maternal and reproductive health, mHealth interventions have been used for prenatal education, pregnancy monitoring, reminders, and counseling, with several studies reporting favorable usability, acceptability, and user satisfaction outcomes [10-12]. High usability and perceived usefulness have been consistently associated with greater adoption, sustained engagement, and user satisfaction across digital health interventions [13-15].

Despite this growing body of work, important limitations remain. Many mHealth interventions in maternal and reproductive health focus on isolated functions such as appointment reminders or clinical monitoring rather than offering integrated, educational support across the full reproductive cycle. Moreover, a substantial proportion of available apps have been developed and evaluated in high-income settings, which may limit their cultural relevance, accessibility, and usability in socioeconomically vulnerable populations. In Latin America, and particularly in Colombia, empirical evidence on culturally adapted mHealth educational interventions remains limited. In regions such as Urabá, longstanding geographical, social, and educational barriers continue to contribute to inequalities in maternal and reproductive health outcomes.

To address these gaps, our digital health tool, HADA Educación, was developed as a culturally contextualized mobile educational platform designed specifically for women in different reproductive stages (fertile age, pregnancy, and postpartum). Unlike many existing mHealth tools, HADA Educación integrates preventive education, recognition of warning signs, and promotion of healthy habits through a structured learning pathway tailored to the user's reproductive stage. Its development incorporated participatory methodologies, including cocreation processes with health professionals and community stakeholders, to ensure cultural relevance, clarity of language, and accessibility for users with diverse educational and socioeconomic backgrounds. Personalization and contextual adaptation are central features of the platform, aiming to reduce barriers to comprehension, build user confidence, and support sustained engagement in vulnerable settings.

Usability it is a key determinant of satisfaction, adoption, and continued use of digital health interventions, and evaluating usability and user satisfaction is a critical first step in assessing the feasibility of our tool as a scalable educational strategy. Prior research across health, educational, and information systems consistently shows that satisfaction is more strongly associated with experiential usability factors such as ease of use, learnability, and perceived simplicity than with demographic characteristics such as age or educational level [13,14]. This relationship is particularly relevant in underserved populations, where confidence in using digital tools may strongly influence adoption and impact.

Therefore, the aim of this study was to evaluate the usability and user satisfaction of HADA Educación among women in fertile age, pregnancy, and postpartum stages in the underserved subregion of Urabá, Colombia. By focusing on usability and satisfaction as core feasibility outcomes, this pilot study seeks to determine whether a culturally adapted and personalized mHealth educational intervention can provide an equitable and acceptable user experience, thereby informing future effectiveness, scalability, and implementation research.

Methods

Study Design and Setting

A prospective observational pilot study was conducted between May and November 2024 in the Urabá subregion of Antioquia, Colombia. Urabá is located in northwestern Colombia, bordering Panama, and includes the Darién Gap, an important migration corridor connecting South and Central America. The region covers approximately 11,664 km^2 and comprises 11 municipalities with an estimated population of 525,685 inhabitants, of whom approximately 51% are women. The general fertility rate is 46 births per 1000 women of reproductive age, and the region is characterized by marked socioeconomic inequalities and limited access to health education, making it a priority setting for digital health interventions [13,14].

This study evaluated the usability, feasibility, and user satisfaction of HADA Educación, a mobile app developed to deliver the Mujer Saludable (Healthy Woman) educational program. The program is a strategy to improve the knowledge of women of fertile age, during pregnancy, and during the postpartum period. It provides evidence-based information on health promotion, disease prevention, recognition of warning signs, healthy lifestyles, and maternal and reproductive health in accordance with the Colombian Comprehensive Maternal and Perinatal Care Pathway. Details about the development

and adaptation process can be found in Multimedia Appendix 1.

Educational priorities were previously identified through a descriptive cross-sectional study involving 1478 women from prioritized municipalities in the Urabá subregion [16]. The findings allowed the identification of the main educational needs of the target population and informed the design of the educational curriculum, including its scope, learning objectives, thematic structure, and microcurricular organization. The educational program was structured around 3 thematic cores: women who are of fertile age, who are pregnant, or who are post partum, designed according to the specific educational needs of each stage. It includes 6 training tracks divided into 19 educational experiences, 51 instructional units, and 190 graphic resources.

The HADA Educación app was designed following user-centered design principles to provide personalized health education tailored to a woman reproductive stage (fertile age, pregnancy, or post partum). Details about the technical development process and software architecture can be found in Multimedia Appendix 2.

Sampling and Recruitment

In accordance with methodological recommendations for pilot and feasibility studies [17], the sample size was determined considering the objectives of the pilot study, operational feasibility, and availability of standardized devices. Due to the limited number of tablets available, the devices were reassigned to new participants after the follow-up period ended.

Study Procedures

Participant recruitment was conducted between May and November 2024 at 4 health care institutions in the Urabá subregion. Three were public institutions: those located in Chigorodó and Carepa provided primary-level (low-complexity) care, whereas the institution in Turbo provided secondary-level (medium-complexity) care. The fourth institution, located in Apartadó, was a private tertiary-level institution providing medium- and high-complexity services. The institutions were selected based on their coverage of urban and rural populations in priority municipalities and their role as referral health centers serving the most populous municipalities in the Urabá subregion.

Eligible participants were women aged 18 to 49 years who resided in the Urabá subregion and had access to Wi-Fi or mobile internet. Recruitment was conducted by a trained social worker following a predefined recruitment protocol. Recruitment sessions were scheduled on different days and at different times according to the availability and outpatient service schedules of each participating institution, allowing recruitment to be conducted across different service periods and supporting broader coverage of the eligible population attending these facilities.

Women attending routine outpatient appointments were invited to participate while waiting for their scheduled appointments. Those who expressed interest received verbal information about the study and an electronic information sheet describing the project and eligibility criteria, together with a link to a preregistration form. The form was used exclusively to identify women interested in participating and to collect contact information (full name, identification number, email address, and mobile phone number) for subsequent follow-up during the recruitment process. Completion of the preregistration form did not constitute enrollment in the study.

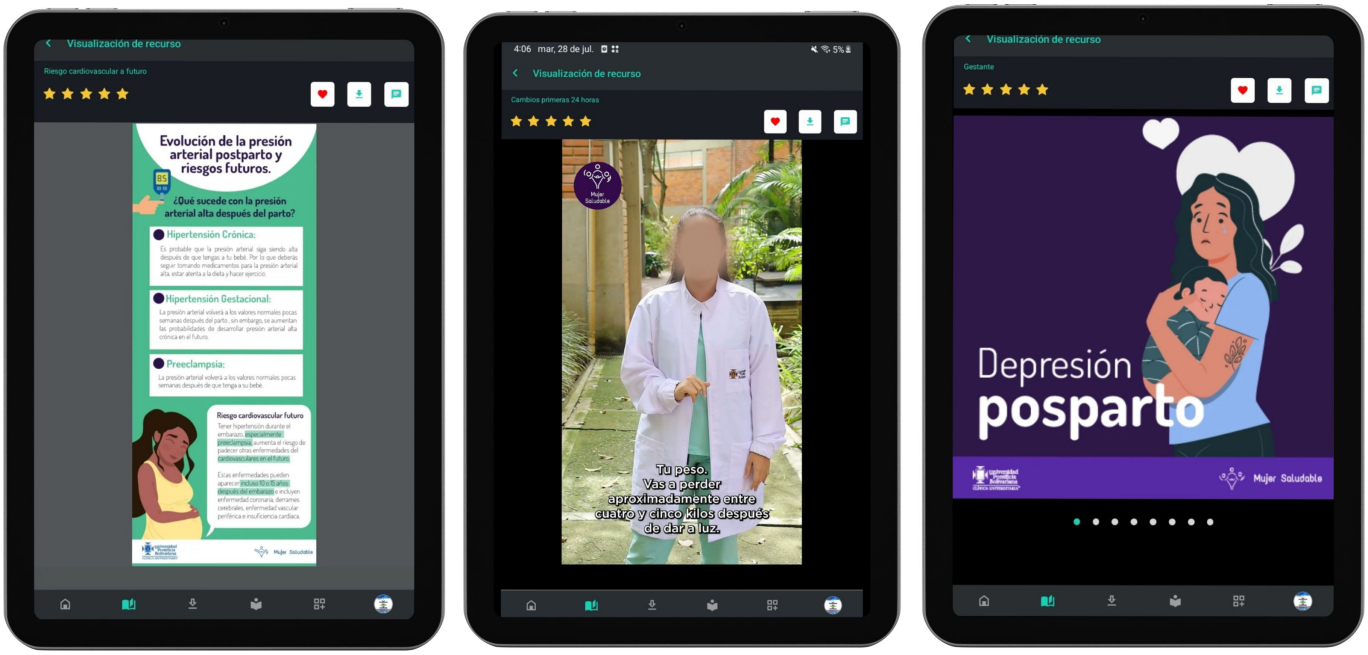
Using the information collected through the preregistration form, the social worker contacted interested women by telephone to confirm their willingness to participate and coordinate the enrollment process. Before receiving the tablet, each participant was provided with detailed information about the study and then signed the informed consent form. Tablets were then delivered at a date and time agreed upon in advance at the health care facility where preregistration had taken place or through a home visit when participants were unable to return to the facility.

Each participant received an Android tablet configured exclusively with the HADA Educación app. After receiving the device, participants completed the formal registration process directly within the app and provided the required sociodemographic information through the app. These variables included age, municipality of residence, educational level, reproductive stage, and socioeconomic stratum. Participants subsequently received instructions on how to use the device and the app.

Socioeconomic stratum was determined according to Colombia's official socioeconomic stratification system established by Law 142 of 1994 [18], which classifies residential properties into six strata: 1 (low-low), 2 (low), 3 (lower-middle), 4 (middle), 5 (upper-middle), and 6 (high).

Following formal registration, participants were classified by the app according to their reproductive stage (fertile age, pregnancy, or post partum) based on the information provided during registration. This classification automatically triggered a personalized learning pathway with educational content tailored to their reproductive stage. Participants accessed the app using their personal credentials and completed sequential learning experiences organized into thematic units, which included multimedia educational resources such as videos, infographics, podcasts, readings, and interactive materials. Passing a knowledge assessment at the end of each learning experience unlocked the subsequent educational content. Participants also had access to a digital resource library containing additional educational materials organized by health topic (Figure 1).

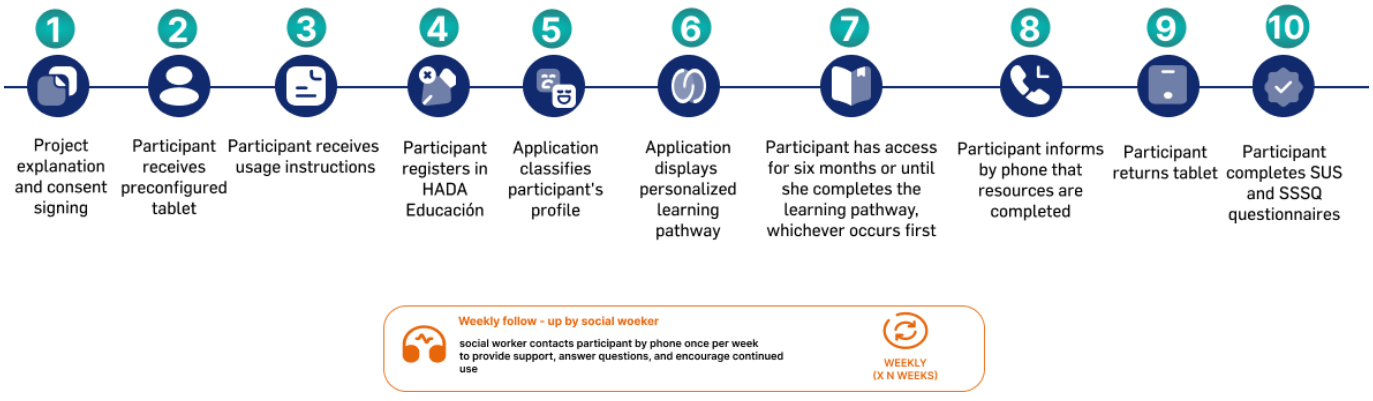
Figure 1. Example of interfaces and educational resources of the HADA Educación mobile health app, developed for women in the fertile age, pregnancy, and postpartum stages, as part of a prospective observational pilot study conducted in the Urabá subregion, Antioquia, Colombia, May to November 2024.



Participants had access for 6 months or until they completed the learning pathway, whichever occurred first. Internet connectivity required for content synchronization was provided through participants' own Wi-Fi or mobile data connections. When necessary, temporary internet access was provided by the research team during enrollment using mobile hotspots to facilitate registration and initial app configuration. During the intervention period, participants received weekly follow-up telephone calls from a social worker to encourage continued use of the app, provide reminders, and monitor their progress through the learning pathway.

Once participants reported completing the educational content, completion was verified through the app records. Then, participants were invited to complete the Spanish version of the System Usability Scale (SUS) [19] and the study-specific satisfaction questionnaire (SSSQ), presented in Microsoft Forms. The SSSQ was pilot-tested before implementation. Finally, the study tablets were returned, and participants signed the corresponding device return documentation (Figure 2).

Figure 2. Participant journey through the HADA Educación digital health intervention, a prospective observational pilot study among women of fertile age, in pregnancy, or in postpartum stages in the Urabá subregion, Antioquia, Colombia, May to November 2024. SSSQ: study-specific satisfaction survey (SSSQ); SUS: System Usability Scale.



Data Analysis

Continuous variables were summarized using medians and IQRs, and categorical variables were summarized as frequencies and percentages. Because the score distributions were skewed and the underlying rating scales were ordinal, all analyses were rank-based. Given the pilot design and the small sample, the analysis was planned as descriptive and estimation-based: no hypothesis testing was performed, no significance thresholds were applied, and all comparisons are reported as effect sizes with 95% CIs. Differences in usability and satisfaction across participant characteristics (reproductive stage, educational level, socioeconomic stratum, and municipality of residence) were quantified as

ε^2 effect sizes derived from the Kruskal-Wallis H statistic, with 95% CIs obtained by bootstrap resampling (2000 resamples). Associations between usability and satisfaction were quantified using Spearman rank correlation coefficients with 95% CIs estimated using the Fisher z approximation. A partial Spearman correlation adjusting for socioeconomic stratum (treated as an ordinal variable) was also estimated to assess the stability of the observed association. Sample composition by municipality of residence was described by contrasting the observed number of participants with the number expected from each municipality's share of the regional population, and the relationship between municipality and reproductive stage was summarized using the Cramér V. Item-level correlations were exploratory and were interpreted on the basis of the magnitude and precision of the estimates rather than as tests. Analyses were performed in Python (version 3.12) using the pandas, NumPy, SciPy, and Pingouin libraries.

Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Health Research Ethics Committee of Universidad Pontificia Bolivariana, Medellín, Colombia (minute number 6, February 27, 2023). All participants signed the informed consent form. All study data were managed using procedures designed to preserve participant confidentiality. Participation in the study was voluntary, and no participants received financial compensation.

Results

Initially, 104 women were identified. Of these, 89 completed enrollment, received a study tablet, and began using the HADA Educación app. Reasons for noncompletion of enrollment among the remaining 15 women were not captured as part of the study protocol. Of the 89 participants who began the intervention, 12 did not complete the full study protocol: 4 were lost to follow-up and did not return the assigned tablet, while 8 completed the educational intervention and returned the tablet but did not complete the postintervention usability and satisfaction questionnaires. Similarly, reasons for noncompletion were not captured as part of the study protocol. Consequently, 77 participants completed the intervention, and both postintervention assessments and were included in the SUS and SSSQ analyses, corresponding to a completion rate of 86.5% among participants who began the intervention. Participant flow is shown in Figure 3.

Among the 89 enrolled participants, the 77 completers had a median age of 31 years (IQR 26-38); the 12 noncompleters had a median age of 32 years (IQR 23-36). Education level varied in both groups: secondary education was the most common level among noncompleters (7/12, 58.3%), while education level was more evenly distributed among completers across secondary, technical/professional, and professional education (22/77, 28.6%; 17/77, 22.1%; and 20/77, 26.0%, respectively). All participants in both groups belonged to low socioeconomic strata (1 to 3), with most in stratum 1 (49/77, 63.6% of completers; 8/12, 66.7% of noncompleters). Participants were categorized into 3 groups according to reproductive stage (fertile age, pregnancy, and post partum); in both groups, most participants were in the fertile age stage (49/77, 63.6% of completers; 9/12, 75% of noncompleters), followed by pregnant and postpartum women. Regarding municipality of residence, completers and noncompleters were recruited across the same 4 municipalities (Apartadó, Carepa, Chigorodó, and Turbo), with Turbo accounting for a comparatively higher proportion of noncompleters (6/12, 50%) than completers (21/77, 27.3%) (Table 1).

The municipal composition of the sample departed from the regional population distribution (see Table 2). Carepa contributed 26 participants against 10.7 expected from its population share, whereas Apartadó (20 observed vs 26.5 expected), Chigorodó (10 vs 13.0), and Turbo (21 vs 26.7) each contributed fewer participants than their population share would imply. Reproductive stage was also unevenly distributed across municipalities (Cramér V=0.30): participants of fertile age were concentrated in Carepa (22/26, 85%), while pregnant and postpartum participants together accounted for 13 of the 21 participants (62%) recruited in Turbo.

Figure 3. Flow diagram of participant recruitment and completion in a prospective observational pilot study of women in fertile age, pregnancy, and postpartum stages recruited from 4 hospitals in the Urabá subregion, Antioquia, Colombia, May to November 2024. SSSQ: study-specific satisfaction survey (SSSQ); SUS: System Usability Scale.

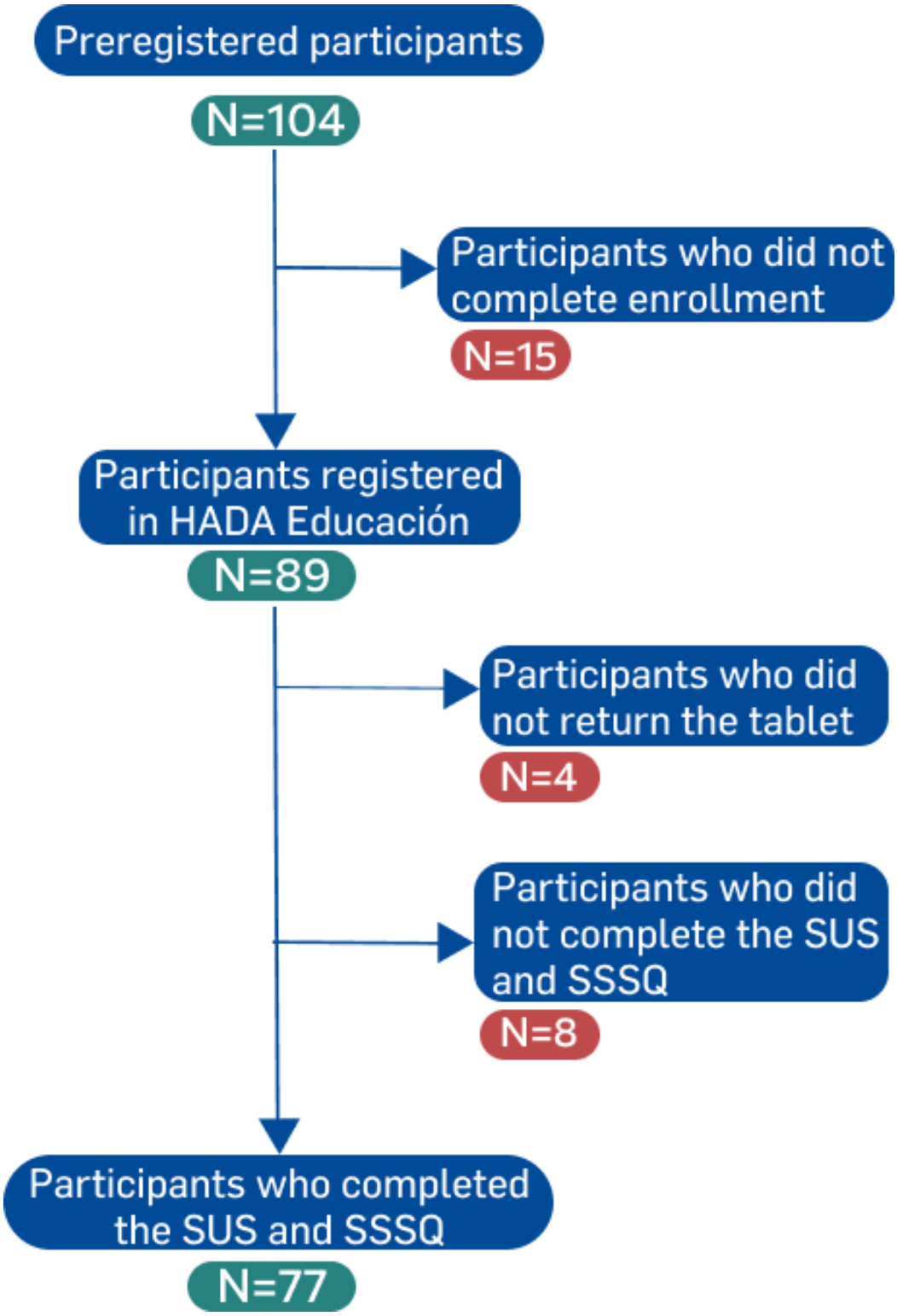


Table 1. Sociodemographic characteristics of completers (n=77) and noncompleters (n=12) among women in the fertile age, pregnancy, and postpartum stages enrolled in this prospective observational pilot study in the Urabá subregion, Antioquia, Colombia, May to November 2024.

Variable	Completers (n=77)	Noncompleters (n=12)
Age (years), median (IQR)	31 (26–38)	32 (20-33)
Education level, n (%)		

Variable	Completers (n=77)	Noncompleters (n=12)
No education	1 (1.30)	0 (0)
Primary education	3 (3.90)	1 (8.33)
Secondary education	22 (28.57)	7 (58.33)
Technical professional	17 (22.08)	2 (16.67)
Technology	10 (12.99)	0 (0)
Professional	20 (25.97)	2 (16.67)
Postgraduate	4 (5.19)	0 (0)
Socioeconomic stratification, n (%)		
1	49 (63.64)	8 (66.67)
2	24 (31.17)	2 (16.67)
3	4 (5.19)	2 (16.67)
Reproductive stage, n (%)		
Fertile age	49 (63.64)	9 (75)
Pregnant	18 (23.38)	2 (16.67)
Postpartum	10 (12.99)	1 (8.33)
Municipality, n (%)		
Apartadó	20 (25.97)	3 (25)
Carepa	26 (33.77)	1 (8.33)
Chigorodó	10 (12.99)	2 (16.67)
Turbo	21 (27.27)	6 (50)

Table 2. Distribution of the 77 study completers by municipality of residence and reproductive stage, compared with estimated population proportions in the Urabá subregion, Antioquia, Colombia, based on enrollment conducted May to November 2024.

Groups	Participants in fertile age stage, n (%)	Participants in pregnant stage, n (%)	Participants in postpartum stage, n (%)	Total participants, n (%)	Population, n (proportion of Urabá population, %)
Municipality	n	n	n	n	Total
Apartadó	14 (18.18)	4 (5.19)	2 (2.60)	20 (25.97)	113,469 (34.45)
Carepa	22 (28.57)	3 (3.90)	1 (1.30)	26 (33.77)	45,929 (13.94)
Chigorodó	5 (6.49)	2 (2.60)	3 (3.90)	10 (12.99)	55,564 (16.87)
Turbo	8 (10.39)	9 (11.69)	4 (5.19)	21 (27.27)	114,434 (34.74)
Total	49 (63.64)	18 (23.38)	10 (12.99)	77 (100)	329,396 (100)

Analysis of the SUS and SSSQ

Among the 77 participants included in the postintervention analyses, the median SUS score was 80.0 (IQR 75.0-92.5). Most participants rated the usability of the app as good or excellent, with 37/77 (48.1%) rating it as good and 34/77 (44.2%) as excellent, together representing 71/77 (92.2%) of the sample, while 6/77 (7.8%) rated it as acceptable (Table 3).

Table 3. System Usability Scale score categories among the 77 women in fertile age, pregnancy, and postpartum stages who completed the postintervention assessment of the HADA Educación mHealth app, Urabá subregion, Antioquia, Colombia, 2024.

Usability rating	Participants, n (%)
Acceptable (<68)	6 (8)
Good (between 68 and 84)	37 (48)
Excellent (≥85)	34 (44)
Total	77 (100)

At the item level, positively worded statements were rated favorably, with medians of 4 to 5 out of 5 and with 91% to 99% of participants agreeing or strongly agreeing across items. Negatively worded statements, for which lower scores indicate more favorable usability, likewise showed favorable medians of 1 to 2, with 80% to 91% of participants disagreeing or strongly disagreeing, indicating that most users did not perceive the system as complex, inconsistent, or requiring technical support (Table 4).

Table 4. Item-level System Usability Scale responses among the 77 study completers in a prospective observational pilot study of the HADA Educación mHealth app, Urabá subregion, Antioquia, Colombia, 2024.

Item	Median	Q1	Q3	IQR
1. I think that I would like to use this system frequently.	4	4	5	4-5
2. I found the system unnecessarily complex.[a]	2	1	2	1-2
3. I thought the system was easy to use.	4	4	5	4-5
4. I think that I would need the support of a technical person to be able to use this system.[a]	2	1	2	1-2
5. I found the various functions in this system were well integrated.	4	4	5	4-5
6. I thought there was too much inconsistency in this system.[a]	2	1	2	1-2
7. I would imagine that most people would learn to use this system very quickly.	4	4	5	4-5
8. I found the system very cumbersome to use.[a]	2	1	2	1-2
9. I felt very confident using the system.	5	4	5	4-5
10. I needed to learn a lot of things before I could get going with this system.[a]	2	1	2	1-2

[a]This is a reverse-scored item.

The results of the SSSQ reflect a positive educational experience among participants. Across items, median responses were at or near the top of the scale (median 5, IQR 4-5 for most items), reflecting favorable perceptions of the program's content, reliability, relevance, and usefulness. The reverse-worded item assessing the need for prior knowledge showed a low median (1, IQR 1-2), indicating that most participants did not consider prior knowledge necessary to understand the program. Full item-level distributions are presented in Table 5.

Table 5. Distribution of responses to the study-specific satisfaction questionnaire among the 77 study completers in a prospective observational pilot study of the HADA Educación mHealth app, Urabá subregion, Antioquia, Colombia, 2024.

Item	Median	IQR	Low, n (%)	Middle, n (%)	High, n (%)
How satisfied are you with the education received?	5	4-5	0 (0)	34 (44)	43 (56)
How reliable is the information to you?	5	4-5	0 (0)	25 (32)	52 (68)
How relevant are the educational contents?	5	4-5	0 (0)	22 (29)	55 (71)
How likely are you to recommend this program?	5	5-5	0 (0)	17 (22)	59 (77)
How likely are you to enroll in a new digital program?	5	4-5	4 (5)	27 (35)	46 (60)
How easy has it been to understand the information?	5	4-5	1 (1)	28 (36)	48 (62)
How useful has the information been to increase your health knowledge?	5	5-5	1 (1)	17 (22)	59 (77)
How likely are you to implement at least one recommendation?	5	4-5	0 (0)	27 (35)	50 (65)
How enjoyable has it been to learn through digital media?	5	4-5	2 (3)	23 (30)	52 (68)
How necessary do you consider prior knowledge to understand the program?[a]	1	1-2	66 (86)	11 (14)	0 (0)

[a]This is a reverse-scored item.

A particularly notable aspect is the program's accessibility. When asked about the need for prior knowledge to understand the content, 34% responded "not at all" and 52% responded "a little." This question, formulated in reverse, indicates that 86% of participants believed that prior knowledge was not necessary to understand the program, which is a highly positive result. This reflects that the instructional design is clear, understandable, and accessible even to those without technical training or prior experience in the subject.

Regarding the learning experience, the results are also encouraging. In total, 68% of respondents indicated that learning through digital media was "extremely" enjoyable, and 65% expressed their willingness to implement at least one of the recommendations received. This suggests not only a pleasant experience but also a high level of appropriation and applicability of the knowledge acquired.

Another strong point of the program is its usefulness in increasing health knowledge: 77% of participants considered the information extremely useful. Similarly, 77% indicated that they would recommend this program to others, reflecting high overall satisfaction and an experience of sufficient value to be replicated or shared.

Regarding the ease of understanding the information, although 62% responded "extremely," 36% chose "quite a lot." While these are positive results, they suggest that there is room for further work to improve the clarity or accessibility of some content.

Usability and Satisfaction by Sociodemographic Characteristics

Because the score distributions were skewed and the response scales ordinal, rank-based methods were used for all subgroup and correlation analyses. Differences across reproductive stages were negligible for both usability (ε^2=0.00, 95% CI 0.00-0.11) and satisfaction (ε^2=0.01, 95% CI 0.00-0.17). Effect sizes were likewise small for educational level (usability ε^2=0.07, 95% CI 0.00-0.31; satisfaction ε^2=0.06,

95% CI 0.00-0.30), socioeconomic stratum (usability ε^2=0.00, 95% CI 0.00-0.12; satisfaction ε^2=0.00, 95% CI 0.00-0.08), and municipality of residence (usability ε^2=0.02, 95% CI 0.00-0.19; satisfaction ε^2=0.06, 95% CI 0.00-0.26). Every CI spanned values compatible both with no subgroup difference and with a modest one, so these estimates are imprecise and are reported as descriptive rather than conclusive. Age and usability scores were essentially unrelated (Spearman ϱ=0.02).

User satisfaction was weakly and positively correlated with total SUS scores (Spearman ϱ=0.30, 95% CI 0.08-0.49), indicating that better perceived usability was associated with higher satisfaction. Item-level, exploratory analyses further showed that satisfaction was associated with usability dimensions related to user confidence (ϱ=0.30, 95% CI 0.08-0.49), intention to use the system frequently (ϱ=0.32, 95% CI 0.10-0.51), and perceived learnability (ϱ=0.26, 95% CI 0.04-0.46). Conversely, negatively worded items reflecting perceived complexity showed inverse correlations with satisfaction, most notably the item "I find this system unnecessarily complex" (ϱ=–0.34, 95% CI –0.52 to –0.13). A partial Spearman correlation adjusting for socioeconomic stratum yielded a similar estimate (ϱ=0.30, 95% CI 0.07-0.49), indicating that adjustment for socioeconomic stratum did not materially alter the observed usability-satisfaction association. Because nearly all participants belonged to strata 1 or 2 (only 4 of 77 were in stratum 3), this adjustment should be regarded as a stability check rather than as meaningful control for socioeconomic position.

Discussion

Principal Findings

This study found that HADA Educación, an mHealth app delivering reproductive stage–tailored health education, was associated with high usability and satisfaction among women recruited from socioeconomically vulnerable settings. A remarkable finding of this pilot study was the high retention rate (86.5%) among participants who began the intervention. This sustained engagement likely resulted from the combination of the provision of dedicated devices, personalized content tailoring, and continuous human support provided via weekly telephone follow-ups by a social worker. Furthermore, achieving a high median usability score (80.0) in a population predominantly belonging to the lowest socioeconomic strata (strata 1-3) is unexpected yet strongly suggests that the participatory cocreation methodologies employed during the app's development successfully mitigated digital literacy barriers. Higher perceived usability was accompanied by higher satisfaction, although this association was weak (ϱ=0.30) and estimated with limited precision. Usability and satisfaction did not differ meaningfully across sociodemographic subgroups. Together, these findings support the acceptability of HADA Educación as a strategy for delivering reproductive health education, although they do not establish its effect on knowledge acquisition or health outcomes.

Comparison With Prior Work

The completion rate observed among participants who initiated the intervention compares favorably with the attrition commonly reported in mHealth interventions, where dropout remains a major and recurring limitation [20]. The retention patterns in our study highlight that in underserved populations, technology alone is rarely sufficient; the weekly structured telephone follow-up and the automatic tailoring of educational content according to reproductive stage likely fostered a sense of accountability and trust that proved critical for maintaining sustained engagement, consistent with evidence that human support and personalization strategies enhance user engagement in digital health interventions [21].

The usability findings compare favorably with the existing mHealth literature: SUS scores previously reported for a mobile app promoting oral health during pregnancy [22], for occupational counseling and self-care apps targeting pregnant women [23,24], and for an app supporting women undergoing assisted reproduction [25] were generally lower than those observed here, and our results are comparable to pooled benchmark values reported for digital health apps more broadly [26].

The positive association between usability and satisfaction is consistent in direction with previous research on information systems and educational technologies [27-30] and aligns with the technology acceptance model [31,32] and the DeLone and McLean information systems success model [33]. Rather than merely reflecting theoretical consistencies, this association demonstrates that in populations with potentially limited exposure to digital health tools, a highly intuitive interface (ease of use) is a crucial prerequisite for users to recognize and value the educational content, linking usability to motivation, enjoyment, and continued engagement [34-36] and facilitating self-regulated learning [34]. Finally, the absence of meaningful differences in usability and satisfaction across sociodemographic subgroups goes beyond the limited precision of our small sample size, though it is broadly consistent with previous systematic reviews [34,35]. It suggests that the extensive cultural adaptation, clear language, and user-centered design integrated into HADA Educación effectively leveled the playing field. By reducing cognitive barriers, the intervention provided an equally accessible and acceptable experience regardless of the user's formal educational attainment or municipality of residence.

Strengths and Limitations

Several factors limit the interpretability and generalizability of these findings. Participant recruitment was conducted using convenience sampling at health centers, which may have introduced selection bias and preferentially included women already connected to health care services and therefore more receptive to digital health interventions, potentially contributing to the favorable findings observed. Consistent with this, the sample was not proportionally representative across municipalities, with Carepa overrepresented relative to its population size; the reason for this imbalance was not captured by the study design. The uneven distribution

of participants across reproductive stages further limits the extent to which these findings can be generalized.

The relatively high proportion of participants with secondary or tertiary education may also have facilitated interaction with the app and favorably biased perceptions of usability and accessibility, consistent with evidence linking higher educational attainment to greater digital health literacy [35]; these characteristics should be considered when interpreting the positive user-experience findings, which may not fully reflect the experience of women with lower educational attainment, limited digital literacy, or less regular contact with health services.

Because noncompleters were not invited to complete the postintervention assessments, the possibility of selection bias in the reported usability and satisfaction estimates cannot be excluded. In addition, the use of convenience sampling, the relatively small sample size, and the lack of systematic assessment of reasons for non-enrollment and noncompletion mean that these findings should not be interpreted as establishing the feasibility or acceptability of the intervention delivery model in broader or more representative populations. Subgroup estimates of usability and satisfaction were imprecise, as reflected in CIs that were wide relative to the effect sizes themselves, and should be interpreted as preliminary evidence of comparable usability and satisfaction across subgroups rather than as confirmation of equivalence.

The intervention was evaluated using tablets provided by the research team rather than participants' personal devices, which may differ from real-world use conditions. Satisfaction was assessed using a study-specific instrument (SSSQ) developed and piloted for this project rather than a previously validated scale, and although the questionnaire included reverse-worded control items to reduce automatic or inconsistent responses, the possibility of social desirability bias cannot be ruled out, as it was not directly measured. The SUS item-level correlations should likewise be regarded as exploratory and hypothesis generating, since the SUS was validated as a unidimensional composite rather than as independently validated subscales.

Finally, this pilot study focused exclusively on usability and satisfaction and did not include pre- and postintervention knowledge assessments or objective health outcome measures. Future iterations should incorporate these measures to evaluate the educational impact of the intervention beyond perceived usability.

Implications and Future Directions

Within the context of socioeconomic vulnerability observed in this population, HADA Educación, as a free, context-adapted digital intervention, represents a promising strategy for reducing barriers to accessing reliable reproductive health information. However, because the primary objective of this study was to evaluate usability and satisfaction, these findings support the app's acceptability and potential for adoption but do not yet establish its impact on educational or health outcomes. HADA Educación is currently undergoing scale-up and evaluation in larger and more diverse populations to determine its effectiveness in improving health learning and other relevant outcomes.

Generative AI Use

For the final preparation and refinement of the manuscript, we used the generative AI tool Claude (Anthropic), including Claude Science. The tool was used to assist with language refinement, organization, and editing. All scientific content, interpretations, and final decisions were reviewed and approved by the authors.

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Data Availability

The datasets generated and analyzed during the current study are not publicly available due to participant confidentiality and institutional restrictions but are available from the corresponding author upon reasonable request.

Authors' Contributions

Conceptualization: IFL-G, JGBG, BSJ-F
Data curation: BSJ-F
Formal analysis: BSJ-F, JFF-A
Investigation: IFL-G, JGBG, BSJ-F, MLB
Methodology: IF-LG, JGBG, BSJ-F, MLB, JFF-A
Project administration: IFL-G
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Visualization: BSJ-F, JFF-A
Writing – original draft: IFL-G (lead), MLB (supporting)
Writing – review & editing: IFL-G (lead), JFF-A (supporting), JGBG (supporting), BSJ-F (supporting), MLB (supporting)

Conflicts of Interest

None declared.

Multimedia Appendix 1

Development of the Mujer Saludable educational program and user-centered content adaptation for HADA Educación.
[DOCX File (Microsoft Word File), 411 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Components Diagram.
[DOCX File (Microsoft Word File), 518 KB-Multimedia Appendix 2]

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Abbreviations

SSSQ: study-specific satisfaction questionnaire
SUS: System Usability Scale

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