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Nurses' Knowledge, Attitude, and Practice toward Smartphone Health Applications in Improving Maternal and Child Health

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ABSTRACT

Background: Mobile health (mHealth) applications have changed healthcare, especially for maternity and child health. These apps offer education, remote monitoring, and clinical support, making them vital in places with fewer resources. Nurses, as primary caregivers, should be leading users. But their knowledge, attitudes, and practices (KAP) differ, affecting how well they use these apps.

Aim: This study aimed to measure nurses' knowledge, attitudes, and practices toward mHealth apps for maternal and child health. It also looks at factors affecting acceptance and how education could improve use.

Subjects and Method: This cross-sectional study was done at Abou Al Monagga Central Hospital, Qalyubia, Egypt, from September to October 2024. Data were collected from 276 female nurses using an online questionnaire shared in WhatsApp and Facebook groups.

Results: Most nurses (98.19%) use smartphones, and 90.94% use health apps. The most used apps were Well-Baby Clinic, Maternal and Child Health Initiative, Sehha, and Egypt Health Passport. Knowledge scores were moderate (2.86/5), with the best understanding in patient education features. Attitudes toward mHealth were mostly positive (3.44/5), especially about privacy and clinical relevance. Practice scores were low (1.36/5), showing poor integration in daily tasks. Key barriers included lack of training, security concerns, and weak infrastructure.

Conclusion: Better training, stronger privacy measures, and system improvements are needed to increase mHealth adoption. Helping nurses use these apps more will improve maternal and child health outcomes.

Keywords: Nurses, mHealth, Maternal Health, Child Health, Health Apps, Egypt.

INTRODUCTION

Mobile health (mHealth) applications have become a transformative tool in healthcare, particularly in maternal and child health (MCH). These applications provide innovative solutions for patient education, remote monitoring, and clinical decision support, addressing critical gaps in resource-limited settings [1].

In 2023, global smartphone app downloads exceeded 250 billion, reflecting the widespread adoption of mHealth technologies [2].

Pregnancy and childcare apps, such as What to Expect and BabyCenter, have attracted millions of users, highlighting their potential to enhance health outcomes [3].

Nurses, as frontline healthcare providers, are well-placed to integrate mHealth tools into clinical practice. Their responsibilities in patient education, monitoring, and care coordination align closely with the capabilities of these technologies [4]. However, despite the increasing availability of mHealth apps, their use among nurses remains inconsistent. Research suggests that while nurses recognize the benefits of mHealth, barriers such as limited training, data privacy concerns, and inadequate infrastructure impede adoption [5,6].

In low- and middle-income countries (LMICs), where maternal and child mortality rates remain elevated, mHealth offers significant promise. Mobile-based interventions have improved antenatal care attendance, immunization rates, and postnatal follow-up in these settings [7,8].

Effective implementation, however, depends on both technological infrastructure and a workforce equipped to use these tools proficiently [9,10].

Although mHealth research is expanding, few studies have explored nurses' knowledge, attitudes, and practices (KAP) toward these technologies, especially in LMICs [11,12]. Understanding these factors is essential for developing interventions to promote mHealth adoption and integration into clinical workflows [13-15]. This study addressed this gap by evaluating nurses' KAP regarding smartphone health applications in the context of MCH in Egypt. By identifying barriers and facilitators, the findings aimed to inform strategies for optimizing mHealth use, thereby improving maternal and child health outcomes.

SUBJECTS AND METHODS

The study was conducted at Abou Al Monagga Central Hospital, located in Qalyubia, Egypt, from September to October 2024. It focused on nurses providing maternal and child health services. The hospital operates a rotational system, ensuring all nurses gain experience in this field. This system justified the inclusion of all nurses in the study, enabling a comprehensive assessment of their knowledge, attitudes, and practices (KAP) toward mHealth applications.

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Study Design

A cross-sectionl survey-based methodology was employed, following similar research models (16). This approach allowed for the simultaneous collection of data on nurses' knowledge, attitudes, and practices related to mHealth applications.

Eligibility Criteria

The study targeted female nurses employed at the hospital. Inclusion criteria encompassed female nurses aged 18-60 years, from students to those nearing retirement. Exclusion criteria were: 1. Male nurses, due to their limited representation (18 of approximately 238 total nurses) and the researcher's observation that female nurses predominantly staff MCH services in hospital and community settings. This aligns with national initiatives, including Presidential Health Campaigns, Children's Vaccination Programs, and Maternal Health Initiatives, where the researcher estimates over 90% of MCH staff have been female over the past four years. Thus, female nurses were considered the most relevant group for assessing KAP regarding smartphone applications for MCH. 2. Non-users of smartphones. Of approximately 220 eligible female nurses, 276 participated, exceeding the planned sample size.

Sample Size

The hospital employs approximately 220 female nurses eligible for participation. A sample size of 95 nurses was initially calculated using a 95% confidence interval and a 5% margin of error, assuming a 50% response rate. However, 276 nurses participated, exceeding expectations and strengthening the dataset for analysis [17].

Recruitment and Data Collection

A convenient sampling method was used to recruit participants. Nurses were invited through WhatsApp and Facebook groups to complete an online survey via Google Forms. The survey was designed to assess their knowledge, attitudes, practices, and barriers related to mHealth apps. The estimated completion time was 10–15 minutes.

Survey Instrument

The survey contained five sections, adapted from validated tools in prior research [17-19]:

- Demographics – Age, marital status, education, experience, and specialization.
- General Smartphone Usage – Frequency and purpose of smartphone use.
- Health Applications Usage – Types, frequency, and features of health-related apps.
- Maternal and Child Health Apps – Awareness, usage, and barriers.
- KAP Assessment – Likert-scale items evaluating knowledge, attitudes, and practices.

Pilot Study: A pilot test was conducted with 15 nurses (10% of the sample) to assess clarity, simplicity, and response time. Feedback was incorporated before finalizing the survey.

Data Analysis

The data were cleaned in Excel and analyzed using JASP software. Descriptive statistics (frequencies, percentages) summarize socio-demographics and app usage patterns. One-way ANOVA was used to assess differences in knowledge scores across education levels, followed by Tukey's post hoc test for pairwise comparisons where ANOVA results were significant. Pearson correlation examined relationships between smartphone use frequency and practice scores. Statistical significance was set at $p < 0.05$.

Ethical consideration:

The study was approved by the Faculty of Medicine Research Ethics Committee, Suez Canal University, Egypt (Approval No. 119311, 14 May 2024). The research followed the ethical standards of the Helsinki Declaration. Participation was voluntary, and informed consent was obtained from all participants before data collection.

RESULTS

This study analyzes a sample of 276 nurses, as shown in table 1: Demographic Information. The most common age group was 21-30 years (47.46%), followed by those under 20 (28.62%). Most participants were married (55.07%), while 41.67% were single. A large proportion (46.01%) had no children, while 31.16% had 1-2 children. Most nurses (56.88%) graduated from a technical institute, and 31.16% had 5-10 years of experience. Nearly all (97.46%) owned a smartphone, ensuring broad relevance for mHealth use.

As shown in table 2: General Smartphone Use Patterns, most participants (96.38%) used Android smartphones, while 3.62% used iPhones (iOS). The most common daily usage was 2–3 hours (31.88%), followed by 1–2 hours (23.91%) and less than 1 hour (22.46%). The most used non-health apps were social media, entertainment, and utility apps (55.44%). WhatsApp (52.90%) was the primary communication tool. The main reason for smartphone use was staying connected (28.99%).

Table 1: Demographic Information

	Domain	No. (%)
Total	276(100%)	
Age	Under 20	79 (28.62)
	21-30	131 (47.46)
	31-40	47 (17.03)
	41-50	16 (5.80)
	51-60	3 (1.09)
Marital Status	Married	152 (55.07)
	Single	115 (41.67)
	Divorced	7 (2.54)
	Widow	2 (0.73)
Number of Children (if any)	0	127 (46.01)
	1-2	86 (31.16)
	3-4	59 (21.38)
	≥ 5	4 (1.45)
Education Level	Nursing School	31 (11.23)
	Technical Institute of Nursing	157 (56.88)
	Bachelor of Nursing	46 (16.67)
	Diploma	14 (5.07)
	Master's Degree	12 (4.35)
	Student	13 (4.71)
	Doctorate	3 (1.09)
Years of Experience	More than 15 years	35 (12.68)
	5-10 years	86 (31.16)
	Less than 5 years	41 (14.86)
	11-15 years	28 (10.15)
	Student	86 (31.16)
Specialization	Other	4 (1.45)
	General	36 (13.04)
	Emergency	24 (8.70)
	Clinics	16 (5.80)
	Operations	2 (0.73)
	Intensive Care	53 (19.20)
	Pediatrics	35 (12.68)
	Infection Control	1 (0.36)
	Training	7 (2.54)
	Anesthesia	2 (0.73)
	Obstetrics/ Gynecology	6 (2.17)
	Surgical Nursing	5 (1.81)
	Student	59 (21.38)
	quality control	4 (1.45)
	Head of Nurses	4 (1.45)
	infection control	7 (2.54)
	public health	3 (1.09)
	Kidney Unit	4 (1.45)
	Physical Therapy Unit nurse	1 (0.36)
	Neonates Nurse	1 (0.36)
	Oncology Nursing	1 (0.36)
	Blood Bank Nursing	1 (0.36)

Table 2: General Smartphone Use Patterns

	Domain	No. (%)
1.Type of operating system?	Android	266 (96.38)
	iPhone (iOS)	10 (3.62)
2.How often do you use your smartphone for your daily activities?	1-2 hours a day	66 (23.91)
	2-3 hours a day	88 (31.88)
	Less than 1 hour a day	62 (22.46)
	More than 3 hours a day	60 (21.74)
3.What types of non-health-related mobile applications do you most frequently use? (Choose all that apply)	Social media apps (e.g., Facebook, Instagram), Entertainment apps (e.g., YouTube, Netflix), Utility apps (e.g., calculator, flashlight)	153 (55.44)
	Utility apps (e.g., calculator, flashlight)	30 (10.87)
	Social media apps (e.g., Facebook, Instagram), Entertainment apps (e.g., YouTube, Netflix)	
4.How do you typically use your smartphone for communication? (Choose all that apply)	WhatsApp, Voice calling	41 (14.86)
	Other	10 (3.62)
	WhatsApp, Email, Voice calling	23 (8.33)
	WhatsApp, SMS text messaging, Email, Voice calling	41 (14.86)
	WhatsApp	146 (52.90)
	WhatsApp, SMS text messaging, Voice calling	10 (3.62)
	SMS text messaging, Voice calling	5 (1.81)
5.What is the primary reason you use your smartphone for non-health-related activities?	To stay connected with family and friends	80 (28.99)
	Other	3 (1.09)
	To gather information from the internet	19 (6.88)
	To stay connected with family and friends, To access entertainment content, To manage personal tasks and productivity, To gather information from the internet	44 (15.94)
	To stay connected with family and friends, To gather information from the internet	28 (10.15)
	To stay connected with family and friends, To access entertainment content, To gather information from the internet	68 (24.64)
	To stay connected with family and friends, To access entertainment content	34 (12.32)

As shown in table 3, General Smartphone Health Applications Use indicates that most participants (90.94%) reported using smartphone health applications, while 9.06% did not. Regarding the types of general health applications used, health education and training apps, such as Medscape and UpToDate, were the most frequently used (42.39%), followed by patient monitoring apps (17.39%) and fitness and exercise apps (12.32%), with a smaller percentage using a combination of these.

In terms of frequency, 50.36% of participants reported never using these apps for information seeking or medical education, while 25.00% used them occasionally, 12.32% several times a week, 11.59% rarely, and only 0.73% used them daily. The most useful feature noted was health status monitoring (78.62%), with other features like appointment scheduling, remote medical consultation, medication dosage, and medical calculators mentioned by fewer participants.

Additionally, 39.49% learned about health applications through training, 17.75% through colleagues, and 17.39% via the internet. Most participants (87.32%) did not rely on social media sites such as Facebook or forums for medical information, while 13.04% did, and a significant majority (95.65%) were unfamiliar with evidence-based medicine, with only 4.35% aware of it.

Table 3: General Smartphone Health Applications Use

	Domain	No. (%)
1. Do you use any smartphone health applications?	Yes	251 (90.94)
	No	25 (9.06)
2.What types of general health applications do you use? (Choose all that apply)	Health education and training apps (e.g., Medscape, UpToDate)	117 (42.39)
	Fitness and exercise apps, Clinical decision-making tools (e.g., MedCalc, diagnostic assistance tools), Patient monitoring apps (e.g., Apple Health, Instant Health Rate)	1 (0.36)
	I am not interested in these apps	16 (5.80)
	Fitness and exercise apps, Health education and training apps (e.g., Medscape, UpToDate), Clinical decision-making tools (e.g., MedCalc, diagnostic assistance tools), Patient monitoring apps (e.g., Apple Health, Instant Health Rate)	5 (1.81)
3.How often do you use smartphone health applications for information seeking or medical education?	Occasionally	69 (25.00)
	Several times a week	34 (12.32)
	Never	139 (50.36)
	Rarely	32 (11.59)
	Daily	2 (0.73)
	Health status monitoring, medication dosage, Medical calculators, Side effect	1 (0.36)
	Health status monitoring, medication dosage, Medical calculators, Side effect, Nutrition	1 (0.36)
	Other	2 (0.73)
	Health status monitoring, Appointment scheduling, Remote medical consultation, medication dosage, Medical calculators, Side effect, Nutrition	43 (15.58)
	Health status monitoring, Medical calculators, Side effect, Nutrition	1 (0.36)
	Health status monitoring, Appointment scheduling, Remote medical consultation, medication dosage,	2 (0.73)

	Domain	No. (%)
4.What features do you find most useful in general health applications? (Choose all that apply)	Medical calculators, Side effect	
	Health status monitoring	217 (78.62)
	Health status monitoring, Appointment scheduling, Side effect	1 (0.36)
	No	4 (1.45)
	Health status monitoring, Appointment scheduling, Remote medical consultation, medication dosage, Side effect	1 (0.36)
	Health status monitoring, Remote medical consultation, medication dosage, Medical calculators, Side effect	1 (0.36)
	Health status monitoring, Remote medical consultation, medication dosage, Medical calculators	1 (0.36)
	Health status monitoring, Appointment scheduling, Remote medical consultation, medication dosage, Medical calculators, Side effect, Nutrition, Other	1 (0.36)
5.If you have health application, how did you find?	Training	109 (39.49)
	colleague	49 (17.75)
	Internet	48 (17.39)
	Other	4 (1.45)
	colleague, Internet, Training	18 (6.52)
	colleague, Training	11 (3.99)
	colleague, Internet	24 (8.70)
	No	13 (4.71)
6.Do you rely on social media sites such as Facebook or forums to obtain medical information?	No	241 (87.32)
	Yes	36 (13.04)
7.Do you Know about Evidence based medicine meaning?	No	264 (95.65)
	Yes	12 (4.35)

As shown in table 4: Smartphone Maternal and Child Health Applications, most participants (75.00%) were unaware of maternal and child health apps, while 25.00% had knowledge of them. Among users, 10.51% used a combination of pregnancy tracking, fetal health monitoring, and nutrition apps. However, 75.73% never used these apps. The main reasons for use included fetal health monitoring (14.86%), while 80.43% reported never using them. Barriers included lack of awareness, technical issues, and privacy concerns (19.57%).

Table 4: Smartphone Maternal and Child Health Applications

	Domain	No. (%)
1.Are you aware of any smartphone applications specifically designed for maternal and child health?	No	207 (75.00)
	Yes	69 (25.00)
2.Which of the following maternal and child health applications have you used? (Choose all that apply)	Never use these apps	209 (75.73)
	Pregnancy tracking apps (e.g., What to Expect, BabyCenter), Fetal health monitoring apps, Child growth and weight monitoring apps	19 (6.88)
	Pregnancy tracking apps (e.g., What to Expect, BabyCenter), Fetal health monitoring apps, Nutrition and diet apps for pregnancy and breastfeeding, Child growth and weight monitoring apps	29 (10.51)
	Pregnancy tracking apps (e.g., What to Expect, BabyCenter), Fetal health monitoring apps	6 (2.17)
	Pregnancy tracking apps (e.g., What to Expect, BabyCenter), Child growth and weight monitoring apps	2 (0.73)
	Pregnancy tracking apps (e.g., What to Expect, BabyCenter)	8 (2.90)
	Fetal health monitoring apps	3 (1.09)
3.How often do you use smartphone applications for maternal and child health-related tasks?	Never	186 (67.39)
	Occasionally	56(20.29)
	Rarely	34 (12.32)
	Never use these apps	222 (80.43)
4.What are the main reasons you use or would use smartphone applications for maternal and child health? (Choose all that apply)	To monitor fetal health during pregnancy, To obtain health education and information on maternal and child health, To manage patient records and appointments, To provide remote medical consultations	41 (14.86)
	To monitor fetal health during pregnancy, To obtain health education and information on maternal and child health, To manage patient records and appointments, To provide remote medical consultations,	1 (0.36)
	To monitor fetal health during pregnancy, To obtain health education and information on maternal and child health	11 (3.99)
	To monitor fetal health during pregnancy	1 (0.36)
5. What are the main barriers you face, or would you face in using smartphone applications for maternal and child health?	Never use these apps	214 (77.54)
	Lack of awareness about available applications, Technical issues (such as poor internet connectivity), Concerns about data privacy and security	6 (2.17)
	Lack of awareness about available applications, Technical issues (such as poor internet connectivity), Concerns about data privacy and security, Resistance to change among patients	54 (19.57)
	Lack of awareness about available applications, Technical issues (such as poor internet connectivity)	2 (0.73)

As shown in table 5: Knowledge, most participants (77.54%) were neutral about their awareness of smartphone health applications for maternal and child health, while 10.15% strongly disagreed and 7.97% agreed. Similarly, 80.07% were neutral about understanding their benefits. Most (78.62%) were neutral about app features, and 74.64% were neutral on using them for patient education. Lastly, 69.93% were neutral about potential risks and limitations, with 13.77% strongly disagreeing.

Table 5: Nurses' Self-Reported Knowledge About Smartphone Health Applications for Maternal and Child Health

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am aware of various smartphone health applications available for maternal and child health.	28 (10.15)	12 (4.35)	214 (77.54)	22 (7.97)	—
I understand how smartphone health applications can benefit maternal and child health care.	7 (2.54)	30 (10.87)	221 (80.07)	17 (6.16)	1 (0.36)
I am familiar with the features of maternal and child health smartphone applications.	21 (7.61)	19 (6.88)	217 (78.62)	19 (6.88)	—
I know how to use smartphone health applications for patient education in maternal and child health.	12 (4.35)	22 (7.97)	206 (74.64)	36 (13.04)	—
I am aware of the potential risks and limitations of using smartphone health applications in clinical practice.	38 (13.77)	17 (6.16)	193 (69.93)	28 (10.15)	—

As shown in table 6: Attitude, nearly 49.64% of participants were neutral about the belief that smartphone health applications improve maternal and child health, while 29.35% agreed and 5.44% strongly agreed. Most (56.16%) were neutral about feeling comfortable using these apps in practice. 56.52% were neutral on whether apps enhance patient engagement, while 32.61% strongly agreed on privacy concerns. Lastly, 57.61% were neutral about whether using these apps is worth the effort.

Table 6: Nurses' Attitudes Toward Smartphone Health Applications for Maternal and Child Health

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe smartphone health applications can improve maternal and child health outcomes.	25 (9.06)	18 (6.52)	137 (49.64)	81 (29.35)	15 (5.44)
I feel comfortable using smartphone health applications in my clinical practice.	1 (0.36)	38 (13.77)	155 (56.16)	71 (25.73)	11 (3.99)
I think smartphone health applications can enhance patient engagement in maternal and child health care.	1 (0.36)	—	156 (56.52)	94 (34.06)	25 (9.06)
I am concerned about the privacy and security of patient data in smartphone health applications.	—	—	135 (48.91)	51 (18.48)	90 (32.61)
I believe incorporating smartphone health applications into practice is worth the effort.	1 (0.36)	—	159 (57.61)	95 (34.42)	21 (7.61)

As shown in table 7: Practice, usage of Smartphone Health Applications, most participants reported never using smartphone health applications to access maternal and child health information (72.46%), while 17.75% rarely used them, and only 2.54% used them often. Similarly, 77.17% never recommended these apps to patients, and 75.36% never used them to monitor patient progress. Regarding clinical decision-making, 78.26% never integrated data from these apps, and only 0.36% reported often doing so. Lastly, while 72.46% never participated in training or self-education on using these apps, 7.97% did so sometimes, and 3.26% did so often.

Table 7: Nurses' Self-Reported Practices Regarding Smartphone Health Applications for Maternal and Child Health

Question	Never	Rarely	Sometimes	Often	Always
I use smartphone health applications to access information about maternal and child health.	200 (72.46)	49 (17.75)	19 (6.88)	7 (2.54)	1 (0.36)
I recommend smartphone health applications to patients for managing their maternal and child health.	213 (77.17)	44 (15.94)	16 (5.80)	2 (0.73)	1 (0.36)
I use smartphone health applications to monitor patients' progress in maternal and child health care.	208 (75.36)	45 (16.30)	18 (6.52)	4 (1.45)	1 (0.36)
I integrate data from smartphone health applications into my clinical decision-making for maternal and child health.	216 (78.26)	43 (15.58)	16 (5.80)	1 (0.36)	—
I participate in training or self-education about using smartphone health applications for maternal and child health.	200 (72.46)	44 (15.94)	22 (7.97)	9 (3.26)	1 (0.36)

As shown in table 8: Average KAP Scores, the Knowledge Section had an average score of 2.86, with the highest score for patient education use (2.96) and the lowest for awareness of risks (2.76).

The Attitude Section averaged 3.44, with privacy concerns scoring highest (3.84) and belief in improving outcomes lowest (3.16). The Practice Section had a low average of 1.36, with minimal use in decision-making (1.28) and patient recommendations (1.31), indicating limited clinical integration.

Table 8: The Average KAP Scores for Each Section Across All Respondents (on a scale of 1-5, where higher scores indicate stronger agreement/more frequent practice)

Section and Items	----------	Mean Score
Knowledge Section	Total score	**2.86**
	Awareness of applications	2.83
	Understanding benefits	2.91
	Familiarity with features	2.85
	Knowledge of patient education use	2.96
	Awareness of risks/limitations	2.76
Attitude Section	Total score	**3.44**
	Belief in improving outcomes	3.16
	Comfort in clinical practice	3.19
	Enhancement of patient engagement	3.51
	Privacy/security concerns	3.84
	Worth the effort	3.49
Practice Section	Total score	**1.36**
	Accessing information	1.41
	Recommending to patients	1.31
	Monitoring patients	1.35
	Integration into decision-making	1.28
	Participation in training	1.43

As shown in table 9: Health App Awareness by Specialization, the Student group had the highest usage, with 91.53% (54/59) using smartphone health applications. Intensive Care nurses followed closely at 94.34% (50/53).

High usage was also seen among General (86.11%) and Pediatrics nurses (91.43%). Emergency, Clinics, and Infection Control reported 87.50%–100% usage. Specialized areas, including Training (71.43%), showed lower participation. Overall, 90.94% of respondents used health applications.

As shown in table 10: Smartphone Health Applications Usage by Education Level, Technical Institute graduates had the highest usage, with 87.92% (138/157) using smartphone health applications. Bachelor's degree holders reported 95.65% usage (44/46), while Nursing School graduates (90.32%) and Diploma holders (100%) also showed high adoption. Students (92.31%) had slightly lower usage.

Master's and Doctorate holders had 100% usage, indicating widespread adoption across education levels.

As shown in table 11: One-way ANOVA: Knowledge Scores Across Education Levels, knowledge scores were compared among education levels. Mean scores ranged from 2.76 (Students) to 2.96 (master's degree holders).

Bachelor's degree holders scored 2.91, while Technical Institute graduates scored 2.83. The p-value (0.05) suggests a potentially significant difference.

Table 9: Health App Awareness by Specialization

	Do you use any smartphone health applications?		
Specialization	**Yes**	**No**	**Grand Total**
Student	54	5	59
Intensive Care	50	3	53
General	31	5	36
Pediatrics	32	3	35
Emergency	21	3	24
Clinics	14	2	16
Infection Control	8		8
Training	6	1	7
Obstetrics/Gynecology	5	1	6
Surgical Nursing	4	1	5
Head of Nurses	4		4
Quality Control	4		4
Kidney Unit	4		4
Other	4		4
Public Health	2	1	3
Anesthesia	2		2
Operations	2		2
Physical Therapy Unit Nurse	1		1
Oncology Nursing	1		1
Neonates Nurse	1		1
Blood Bank Nursing	1		1
Grand Total	251	25	276

Table 10: Smartphone Health Applications Usage by Education Level

	Do you use any smartphone health applications?		
Education Level	Yes	No	Grand Total
Technical Institute	138	19	157
Bachelor's Degree in Nursing	44	2	46
Nursing School	28	3	31
Diploma	14		14
Student	12	1	13
Master's Degree	12		12
Doctorate	3		3
Grand Total	251	25	276

Table 11: One-Way ANOVA: Knowledge Scores Across Education Levels

Education Level	Sample Size	Mean Knowledge Score ± SD	p-value
Nursing School	31	2.86 ± 0.42	0.05
Technical Institute	157	2.83 ± 0.38	
Bachelor of Nursing	46	2.91 ± 0.41	
Diploma	14	2.85 ± 0.39	
Master's Degree	12	2.96 ± 0.45	
Student	13	2.76 ± 0.37	
Doctorate	3		

As shown in table 12: Smartphone Use Frequency and Practice Scores, practice scores were analyzed across smartphone usage categories. Participants using smartphones for 1–2 hours daily had the highest practice score (1.41), while those using them for more than 3 hours had the lowest (1.28). 2–3 hours (1.31) and less than 1 hour (1.35) fell in between. The p-value (0.05) suggests a potential significance. Post Hoc Test (Tukey): Significant differences between >3 hours vs. 1–2 hours ($p = 0.02$). One-way ANOVA was used for group comparisons. with Tukey's post hoc test applied for significant results Pearson correlation ($r = 0.12$, $p = 0.03$) indicated a weak positive relationship between smartphone use frequency and practice scores.

Table 12: Smartphone Use Frequency and Practice Scores

Frequency	%	Practice Score ± SD	p-value
1-2 hours a day	23.91	1.41 ± 0.28	0.05
2-3 hours a day	31.88	1.31 ± 0.25	
Less than 1 hour a day	22.46	1.35 ± 0.26	
More than 3 hours a day	21.74	1.28 ± 0.24	

DISCUSSION

This study investigated nurses' use of smartphone health applications, focusing on those designed for maternal and child health (MCH), and identified both opportunities and challenges in their clinical application.

Smartphone ownership was nearly universal (276, 97.46%), with Android devices predominating (266, 96.38%), reflecting global trends in healthcare settings [1]. This high adoption rate aligns with findings from low- and middle-income countries [7], where mobile technology is increasingly accessible. However, despite extensive smartphone use, engagement with health applications remained limited, echoing the technology-utilization gap noted in previous research [4,8].

Participants' knowledge of smartphone health applications was moderate (mean score: 2.86/5), with the lowest awareness related to security risks and limitations (2.76/5). This knowledge deficit is concerning, as understanding the benefits and risks of mHealth tools is crucial for their effective use [2, 13]. Structured education programs, as recommended by international guidelines [1], could enhance nurses' understanding and confidence.

Attitudes toward smartphone health applications were generally positive (mean score: 3.44/5), particularly regarding their potential to improve patient engagement (3.51/5). This favorability is consistent with studies on mHealth interventions in maternal care [9,10]. However, privacy and security concerns were prominent (3.84/5), a barrier frequently cited in mHealth adoption literature [14,20].

Despite positive attitudes, practical use was minimal (mean score: 1.36/5), with the lowest score for integrating health app data into clinical decision-making (1.28/5). This attitude-practice gap highlights the need for better integration strategies [5,15]. Key barriers included lack of workflow integration, privacy concerns, and insufficient training, challenges extensively documented in mHealth implementation research [6,11,18].

Usage varied by education, specialization, and experience, with nurses holding advanced degrees and those in intensive care showing higher engagement. This pattern suggests that targeted training and support could promote wider adoption [12,19].

To address these barriers, healthcare systems should prioritize practical training, enhance data security, and facilitate seamless workflow integration, as emphasized in recent systematic reviews [2,6,11].

CONCLUSION AND RECOMMENDATIONS

Although smartphone health applications are widely available, their integration into nursing practice remains limited. To bridge this gap, structured training programs must be implemented to improve nurses' knowledge of application benefits, security risks, and best practices. Education initiatives should be tailored to different experience levels and specializations to ensure relevance and effectiveness.

Privacy concerns should be addressed through enhanced cybersecurity policies and clear guidelines on

data protection. Collaboration between healthcare institutions, policymakers, and technology developers is crucial to facilitate seamless adoption of mHealth applications. Strengthening these efforts will enhance maternal and child health outcomes and promote efficient digital healthcare solutions.

LIMITATION

- The study was conducted at a single hospital, limiting generalizability to other settings.
- It did not assess clinical outcomes or the impact of application use on patient care.
- The cross-sectional design captures associations but does not establish causality.

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REFERENCES

1. **World Health Organization (2011):** mHealth: New Horizons for Health Through Mobile Technologies. Global Observatory for eHealth Series., 3:1-112. https://iris.who.int/handle/10665/44607.
2. **Knop M, Nagashima-Hayashi M, Lin R *et al.* (2024):** Impact of mHealth Interventions on Maternal, Newborn, and Child Health from Conception to 24 Months Postpartum in Low- and Middle-Income Countries: A systematic review. BMC. Med., 22:196. doi.org/10.1186/s12916-024-03417-9.
3. **Statista (2023):** Annual number of mobile app downloads worldwide. www.statista.com/statistics/271644/worldwide-free-and-paid-mobile-app-store-downloads/
4. **Holden R, Karsh B (2010):** The Technology acceptance model: Its past and its future in health care. J. Biomed. Inform., 43, 159–172. doi.org/10.1016/j.jbi.2009.09.002.
5. **Alrasheeday A, Alshammari B, Alkubati S *et al.* (2023):** Nurses' attitudes and factors affecting use of electronic health records in Saudi Arabia. Healthcare (Basel), 11(17):2393. doi.org/10.3390/healthcare11172393.
6. **Elliot M, Maureen N (2024):** Mobile health interventions for improving maternal and child health outcomes in South Africa: A systematic review. Global Health Journal, 8(3): 2414. doi.org/10.1016/j.glohj.2024.08.002.
7. **Chib A, van Velthoven M, Car J (2015):** mHealth adoption in low-resource environments: A review of the use of mobile healthcare in developing countries. J. Health Commun., 20(1):4-34. doi.org/10.1080/10810730.2013.864735.
8. **Venkatesh V, Morris M, Davis G *et al.* (2003):** User acceptance of information technology: Toward a unified view. MIS Q., 27(3):425-478. ssrn.com/abstract=3375136.
9. **Bonciani M, De-Rosis S, Vainieri M (2021):** Mobile health intervention in the maternal care pathway: Protocol for the impact evaluation of hAPPyMamma. JMIR. Res. Protoc., 10(1): e19073. doi.org/10.2196/19073.
10. **Chan K, Chen M (2019**): Effects of social media and mobile health apps on pregnancy care: Meta-analysis. JMIR. Mhealth Uhealth, 7(1): e11836. doi.org/10.2196/11836.
11. **Ameyaw E, Amoah P, Ezezika O (2024):** Effectiveness of mHealth apps for maternal health care delivery: Systematic review of systematic reviews. J Med Internet Res., 26: e49510. doi.org/10.2196/49510.
12. **Milne-Ives M, Lam C, Van-Velthoven M *et al.* (2020):** Mobile apps for health behavior change: Protocol for a systematic review. JMIR. Res. Protoc., 9(1): e16931. doi.org/10.2196/16931.
13. **Lee S, Nurmatov U, Nwaru B *et al.* (2016**): Effectiveness of mHealth interventions for maternal, newborn and child health in low- and middle-income countries: Systematic review and meta-analysis. J. Glob. Health, 6(1):010401. doi: 10.7189/jogh.06.010401.
14. **Cajita M, Hodgson N, Lam K *et al.* (2018):** Facilitators of and Barriers to mHealth Adoption in Older Adults with Heart Failure. Comput. Inform. Nurs., 36(8):376-382. doi.org/10.1097/CIN.0000000000000442.
15. **Kabongo E, Mukumbang F, Delobelle P *et al.* (2021):** Explaining the impact of mHealth on maternal and child health care in low- and middle-income countries: A realist synthesis. BMC. Pregnancy Childbirth, 21:196. doi.org/10.1186/s12884-021-03684-x.
16. **Calculator.net (2024):** Sample size calculator. www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=5&pp=50&ps=110&x=Calculate
17. **Peng Y, Wang H, Fang Q *et al. (*2020**): Effectiveness of mobile applications on medication adherence in adults with chronic diseases: A systematic review and meta-analysis. J. Manag. Care Spec. Pharm., 26(4):550-561. doi.org/10.18553/jmcp.2020.26.4.550.
18. **Mazaheri H, Moghbeli F, Langarizadeh M *et al.* (2024):** Mobile health apps for pregnant women: Usability and quality rating scales: A systematic review. BMC. Pregnancy Childbirth, 24:34. doi.org/10.1186/s12884-023-06206-z.
19. **Carter J, Sandall J, Shennan A *et al.* (2019):** Mobile phone apps for clinical decision support in pregnancy: A scoping review. BMC. Med. Inform. Decis. Mak., 19:219. doi.org/10.1186/s12911-019-0954-1.

Taber K (2018): The use of Cronbach's alpha when developing and reporting research instruments in science Education. Res. Sci. Educ., 48:1273-1296. doi.org/10.1007/s11165-016-9602-2.