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The Role of Technology in Improving Reproductive Health Services in Libya: Innovative Solutions, Future Challenges, and the Awareness of Libyan Women

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Abstract

People talk a lot about technology in healthcare these days. It helps make things more accessible and efficient. This goes for reproductive health services too. Still in Libya things look different. There is not much evidence on how technology gets used there. Challenges in putting it into practice are not well studied. Researchers did a descriptive analytical cross-sectional study. They used two structured questionnaires. These went to 103 participants in Tripoli Libya. Selection was by convenience sampling. Out of these 90 were patients from the general public. Thirteen were gynecologists. Data collection happened from January to April 2025. Some was in person at Tripoli Children's Hospital. Other parts were online. Each questionnaire had two main sections. One covered demographic and personal data. The other looked at technology experiences. This included awareness and usage patterns. It also covered perceived benefits barriers and expectations for reproductive health apps. The study wanted to look closely at technology's role in bettering reproductive health services in Libya. It aimed to check how technological innovations affect healthcare access and community awareness. Plus, it sought to spot the main challenges. Most participants knew about reproductive health apps. That was 87.78 percent. But only 63.29 percent actually used them. They mainly used these for ovulation tracking and medical consultations. The top benefits people saw were better care quality at 37.78 percent. Quick access to information came in at 34.44 percent. Barriers stood out too. Lack of trust was the biggest at 50 percent. Insufficient training hit 32 percent. Also, 54 percent said they used apps only sometimes. They did this without talking to doctors first. For gynecologist's 76.92 percent used digital tools. WhatsApp was the most common. But they pointed to patient unawareness as the top issue. That was 58.82 percent. Awareness of technology in reproductive health is high in Libya. Both the public and professionals see positives in it. Still barriers remain big. These involve infrastructure digital literacy and lack of institutional support. Fixing these is key. Only then can technology really boost reproductive health outcomes.

Keywords: Reproductive health. Digital health applications. Technology adoption. Healthcare accessibility. And Libya.

الملخص:

أصبح الحديث عن دور التكنولوجيا في القطاع الصحي متزايدًا في الوقت الحاضر، نظرًا لما توفره من سهولة في الوصول إلى الخدمات وتحسين كفاءتها، وينطبق ذلك أيضًا على خدمات الصحة الإنجابية. إلا أن الواقع في ليبيا يختلف نسبيًا، حيث لا تزال الأدلة العلمية حول استخدام التكنولوجيا في هذا المجال محدودة، كما أن التحديات المرتبطة بتطبيقها لم تُدرس بشكل كافٍ . أُجريت هذه الدراسة باستخدام المنهج الوصفي التحليلي وبتصميم مقطعي(Cross-sectional study) ، حيث تم الاعتماد على استبيانين منظمين وُزعا على عينة قوامها 103 مشاركين من مدينة طرابلس، ليبيا، تم اختيارهم بطريقة العينة الملائمة (Convenience sampling).شملت العينة 90 مشاركًا من عامة الجمهور و13 طبيبًا مختصًا في أمراض النساء والتوليد. جُمعت البيانات خلال الفترة من يناير إلى أبريل 2025، وذلك من خلال مقابلات مباشرة في مستشفى طرابلس للأطفال، إضافة إلى جمع بيانات عبر الإنترنت. احتوى كل استبيان على قسمين رئيسيين: القسم الأول تناول البيانات الديموغرافية والشخصية، بينما ركّز القسم الثاني على تجارب استخدام التكنولوجيا، بما في ذلك مستوى الوعي، وأنماط الاستخدام، والفوائد المتصوَّرة، والمعوقات، والتوقعات المتعلقة بتطبيقات الصحة الإنجابية.

هدفت الدراسة إلى تحليل دور التكنولوجيا في تحسين خدمات الصحة الإنجابية في ليبيا، وتقييم تأثير الابتكارات التكنولوجية على إمكانية الوصول إلى الرعاية الصحية ورفع مستوى الوعي المجتمعي، بالإضافة إلى تحديد أبرز التحديات التي تعيق استخدامها . أظهرت النتائج أن نسبة مرتفعة من المشاركين (87.78٪) لديهم وعي بتطبيقات الصحة الإنجابية، إلا أن 63.29٪ فقط يستخدمونها فعليًا، وكان الاستخدام الأكثر شيوعًا لأغراض تتبع الخصوبة والاستشارات الطبية. تمثلت أبرز الفوائد المدركة في تحسين جودة الرعاية الصحية (37.78٪) وسرعة الوصول إلى المعلومات (34.44٪). في المقابل، برزت عدة معوقات، كان أهمها ضعف الثقة في هذه التطبيقات (50٪) ونقص التدريب (32٪). كما أشار 54٪ من المشاركين إلى أنهم يستخدمون التطبيقات بشكل متقطع ودون استشارة الطبيب. أما بالنسبة للأطباء، فقد أفاد 76.92٪ منهم باستخدام الأدوات الرقمية، وكان تطبيق "واتساب" الأكثر استخدامًا، إلا أنهم اعتبروا ضعف وعي المرضى بالتكنولوجيا التحدي الأبرز (58.82%) وتوصلت الدراسة إلى أن مستوى الوعي بالتكنولوجيا في مجال الصحة الإنجابية مرتفع نسبيًا في ليبيا، وأن كلًا من أفراد المجتمع والعاملين الصحيين يدركون فوائدها المحتملة. ومع ذلك، لا تزال هناك تحديات كبيرة تتعلق بالبنية التحتية، ومحدودية الثقافة الرقمية، وضعف الدعم المؤسسي، الأمر الذي يستدعي معالجتها لضمان الاستفادة الفعالة من التكنولوجيا في تحسين مخرجات الصحة الإنجابية.

الكلمات المفتاحية: الصحة الإنجابية، تطبيقات الصحة الرقمية، تبني التكنولوجيا، إتاحة الخدمات الصحية، ليبيا

Introduction

In their quest to achieve universal health coverage (UHC) and better public health (as articulated in the Sustainable Development Goals [SDG 3]), creative solutions are needed, especially for regions with severe systemic constraints. Reproductive health (RH) itself is a building block in this agenda and covers a gamut of services right from family planning to maternal and newborn care. In several developing and post-conflict countries, such as Libya, access to these services is increasingly underpinned by a combination of intricate infrastructural, socio-political and economic impediments [1]. The ten years of conflict and post-conflict crises in Libya have deeply fractured the health system and there is now an acute shortage of trained medical professionals, disrupted lines of supply, and a decreased access for people who are located in remote locations or who suffer from marginalization [2]. The rapid expansion of digital technology in recent years has become a promising approach to alleviate those healthcare disparities. At the global level, with popularization of digital health such as telemedicine/telehealth, the mobile health (mHealth) application and e-health record were found to be able to improve accessibility and promote individual empowerment in health information sharing among individuals and physicians [3]. These emerging technologies hold potential for connecting distances, bypassing deteriorated infrastructure, and providing private care in an emotionally safe format. Such innovative approaches could be used in fragile settings, such a Libya, however, presents unique challenges, including issues of digital literacy, data privacy, and the need for a robust regulatory framework.

Thing is, digital health technologies show a lot of promise. But there's still this big gap in the research when it comes to looking at how they actually apply to reproductive health in Libya. Some studies cover the general healthcare scene in the country. Others talk about using digital tools in different places around the world. Still, nothing really gets into a full breakdown of integrating these technologies to boost reproductive health services for women there. This study sets out to close that gap. It explores the way technology can help improve how those services get delivered right in the Libyan context [4]. This paper looks into the state of reproductive health services in Libya right now. It checks out how new tech ideas, like m Health apps for family planning and telemedicine for prenatal care, could help fix some of the big problems there. Thing is, it also digs into the roadblocks ahead for getting these technologies out to more people. You have infrastructural issues, policy hurdles, and even socio-cultural stuff that affects how aware and open Libyan women are to digital health tools. Still, the research findings should give some solid pointers for policymakers, healthcare folks, and international groups. They all want to use tech to make the reproductive health system in Libya tougher and easier to reach [5]

1. Methodology

This study uses a descriptive analytical cross-sectional approach. It looks at how technology helps improve reproductive health services in Tripoli, Libya. That kind of design really matters. It lets researchers gather data from one moment in time. They can see current situations, how things get used, and what people think about it all. The research pays attention to patients and healthcare providers both. That gives views from two sides. It makes the assessment of technology completer and more detailed. Users get covered, and so do the providers.

Study Setting and Participants.

The work happened at Tripoli Children's Hospital. It also took place at the Faculty of Medical Technology, University of Tripoli. The group involved had two different parts. That setup aimed to give a full picture:

. Patients: A group of 90 patients from the general public. A

. Gynecologists: A group of 13 gynecologists serving as healthcare providers. B

We went with convenience sampling to pick out those 103 people involved. That included 90 patients along with 13 gynecologists. The thing is, this approach just made sense in a real-life setup. It let them gather data pretty quickly from folks who were easy to reach and fit the study's needs.

Data Collection Tools

We used two different structured questionnaires for this. Each one was made just for the group answering it, whether patients or the doctors. Sticking to structured ones helped keep everything consistent. Plus, it made it possible to measure things tied to tech and reproductive health in a clear way. People filled them out either right there at Tripoli Children's Hospital or online. That setup gave more flexibility. It also helped pull in a wider mix of participants.

The questionnaires covered a few main spots. Like awareness about apps for reproductive health. Usage habits too. Then there were thoughts on benefits people saw. Challenges they ran into. And what folks expected down the line.

The patient questionnaire included

The patient questionnaire looked at a few main things. Demographic stuff like age, marital status, education level. Then awareness and how people used reproductive health apps and other digital tools. They also asked about perceived benefits and challenges with these technologies. Preferences came up too, along with recommendations for what features the apps should have.

The gynecologist’s questionnaire covered their professional background and experience. It included their own experience with digital health tools in practice. Perceptions of how patients used apps got a section. Clinical benefits and limitations of reproductive health applications were discussed. Suggestions for integrating technology into reproductive health services rounded it out.

Data collection:

happened over four months. That was from January to April in 2025. Questionnaires went out to participants who consented. In-person collection at the hospital meant direct interaction and pretty high response rates. The online option let people join who could not make it to the hospital. This dual setup really boosted the studies efficiency and reach.

statistical analysis:

The data were analyzed using descriptive statistical methods through Microsoft Excel. Frequencies and percentages were calculated to summarize the participants' demographic characteristics, awareness levels, usage patterns, and perceived benefits and challenges related to reproductive health technologies. The results were presented in tables and figures to illustrate key trends and distributions. No inferential statistical tests were applied, as the study aimed to describe the current situation rather than test hypotheses

3.Results

This The study was conducted on a sample of 103 participants in Tripoli, Libya, including 90 patients and 13 gynecologists. Data were collected to evaluate the awareness, usage patterns, perceived benefits, and challenges related to the use of technology in reproductive health services

Table 1. Distribution of Demographic data of Study Participants

Variables		N (%)
Age	18-24	47 (52.22%)
	25-30	22 (24.44%)
	31-40	14 (15.56%)
	Above 44 years	7 (7.78%)
Marital status	Married	37 (41.11%)
	Single	53 (58.89%)
If you are married, do you have children?	Yes	31 (83.78%)
	No	6 (16.22%)
Educational level	Basic education	4 (4.44%)
	Intermediate education	8 (8.89%)
	University education	68 (75.56%)
	Higher education	10 (11.11%)
Occupation	Teacher	10 (11.11%)
	Medical staff	37 (41.11%)
	Housewife	21 (23.33%)
	Other	22 (24.44%)
Residential area	City	75 (83.33%)
	Countryside	13 (14.44%)
	Village	2 (2.22%)

Demographic data were collected from 90 participants. The predominant age group was between 18 and 24 years (n = 47, 52.22%), followed by those aged 25 to 30 (n = 22, 24.44%). Regarding marital status, the majority of participants were single (n = 53, 58.89%), while 37 participants were married (41.11%), of whom 83.78% had children. In terms of educational level, most of the sample held a university degree (n = 68, 75.56%). Concerning occupation, medical staff constituted the largest group (n = 37, 41.11%). Finally, data on residence showed that the majority of participants lived in a city (n = 75, 83.33%)

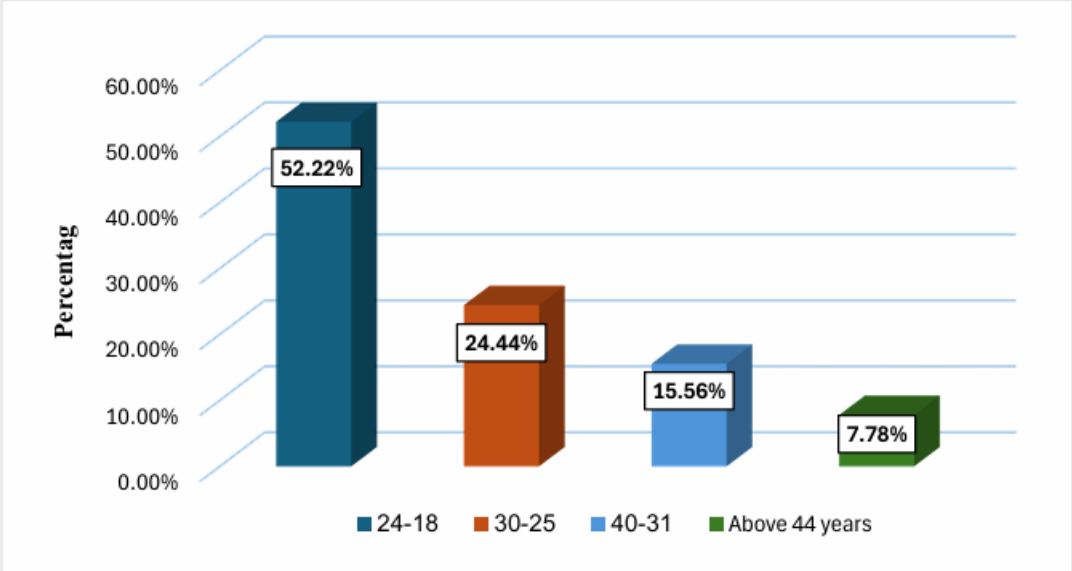

Fig 1. Distribution of Age

Figure (1) shows that the majority of Participants, (52.22%), fall within the 18–24 years age group, followed by 24.44% in the 25–30 years group. The 31–40 years group represents 15.56%, while the Above 44 years category makes up the smallest portion at only 7.78%.

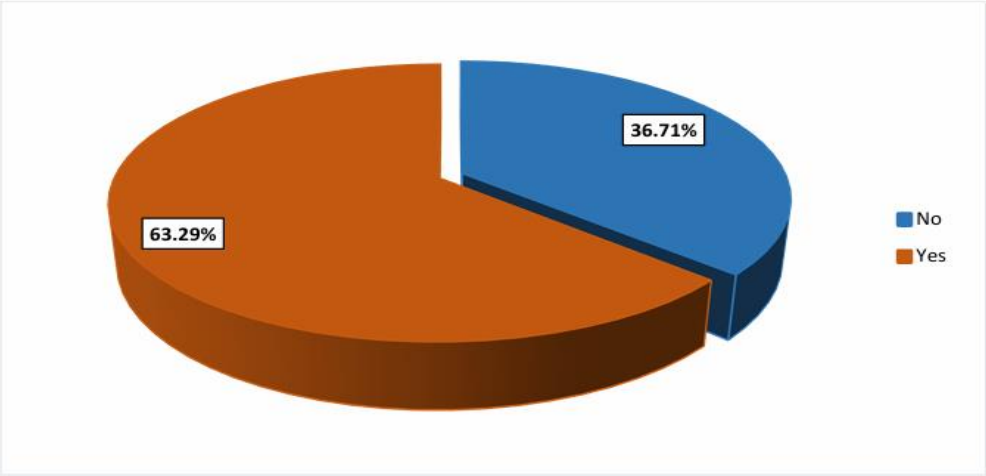

Fig 2. Distribution of responses to the question: Do you use applications to improve reproductive health**?**

Figure (2) shows that out of the 79 participants who had heard about reproductive health applications, 50 participants (63.29%) reported that they currently use such applications, while 29 participants (36.71%) stated that they do not use them.

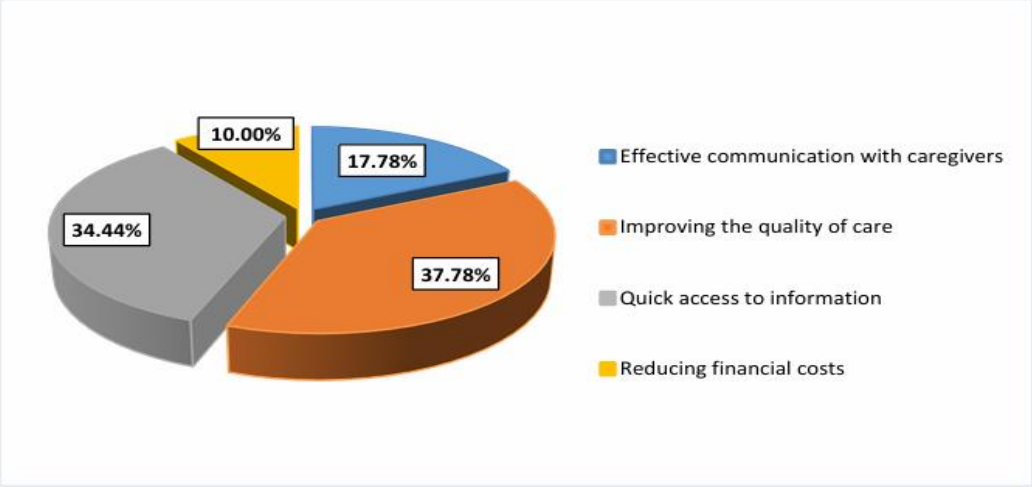

Fig 3. Distribution of responses to the question: "In your opinion, what are the main benefits of technology in reproductive health?

Figure (3) shows that all participants (n = 90) responded to the question. the majority (37.78%) identified improving the quality of care as the main benefit. This was followed by quick access to

information (34.44%), and effective communication with caregivers (17.78%). the least cited benefit was reducing financial costs, reported by only 10.00% of participants.

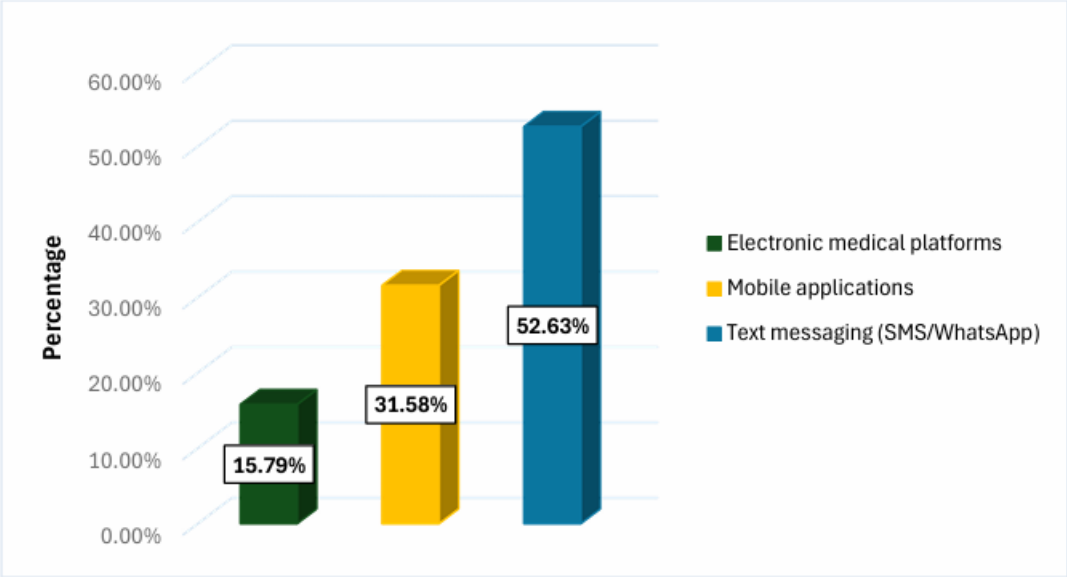

Fig 4. Distribution of type of technology used by gynecologists in the study

Figure (4) shows that the most commonly used technology by gynecologists was text messaging (SMS/WhatsApp), reported by (52.63%) of participants. This was followed by mobile applications, used by (31.58%), while only (15.79%) reported using electronic medical platforms.

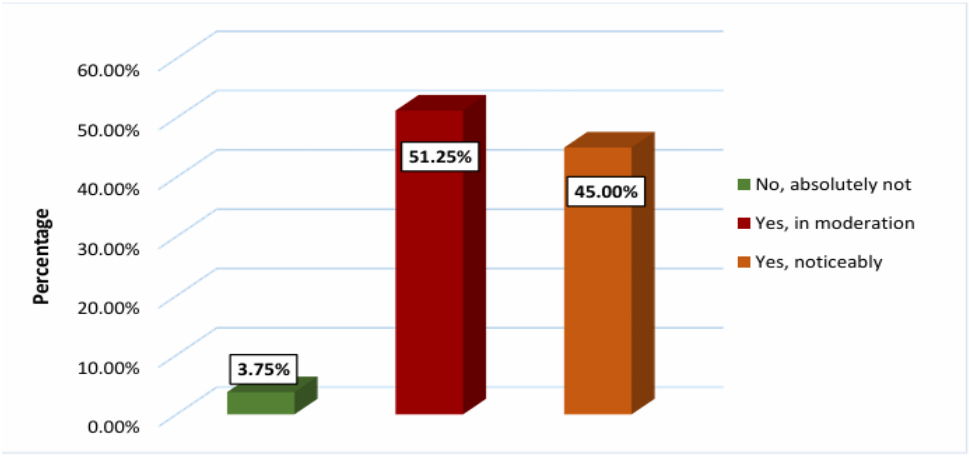

Fig 5. Distribution of responses to the question: Do you think these applications will play a bigger role in the future?

Figure (5) shows that among the 79 participants who had heard about reproductive health applications, 51.25% believed that these applications will play a bigger role in the future to a

moderate extent, while 45.00% believed their role will increase noticeably. Only 4.00% thought they absolutely will not play a bigger role in the future.

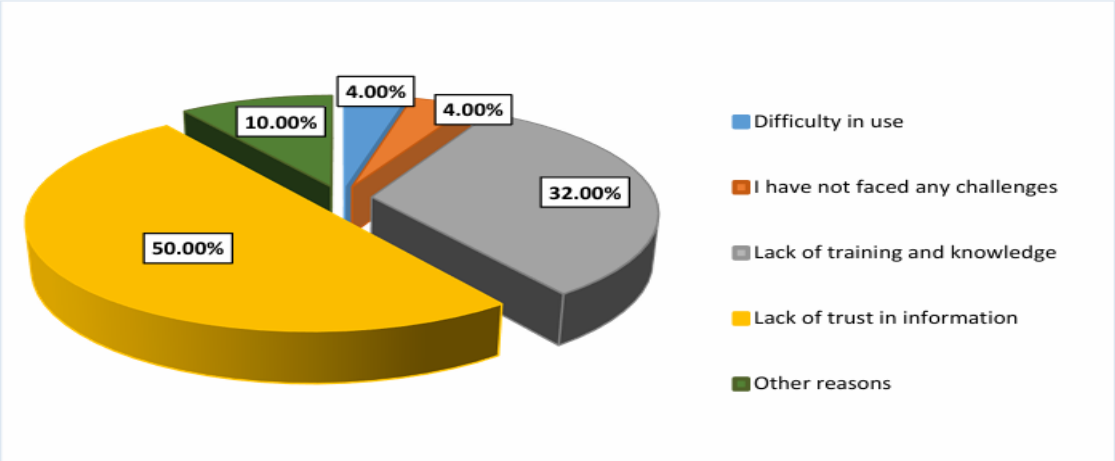

Fig 6. Distribution of responses to the question: What challenges have you faced while using these applications?

Figure (6) shows that among the 50 participants who reported using reproductive health applications, the most commonly reported challenge was a lack of trust in the information (50.00%). This was followed by a lack of training and knowledge (32.00%). Other reasons were mentioned (10.00%), while both "I have not faced any challenges" and "difficulty in use" were each reported (4.00%).

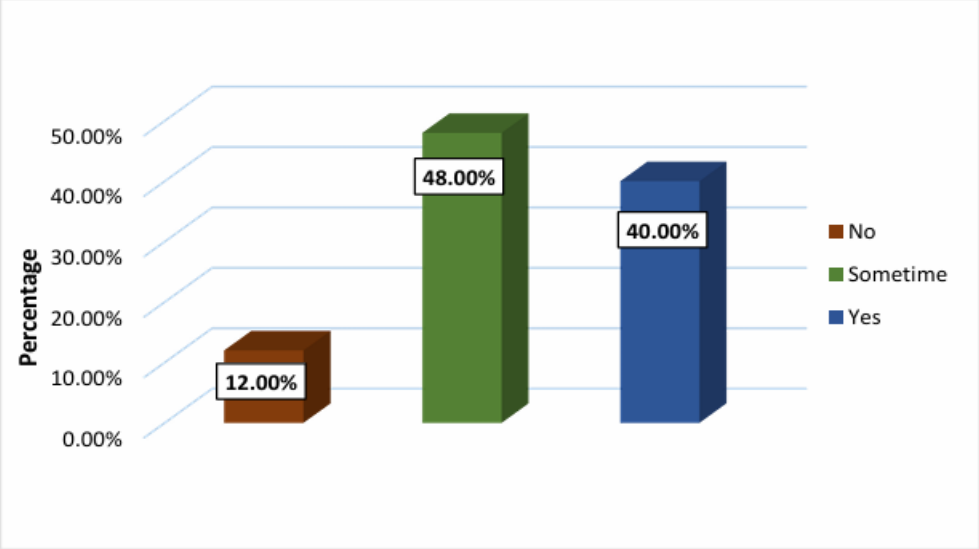

Fig 7. Distribution of responses to the question: Are these applications useful to improve reproductive health?

Figure (7) shows that among the 50 participants who reported using reproductive health applications, 48.00% believed that these applications are sometimes useful in improving reproductive health. A further 40.00% responded yes, indicating they find the applications useful. Meanwhile, only 12.00% of participants did not consider the applications useful for improving reproductive health.

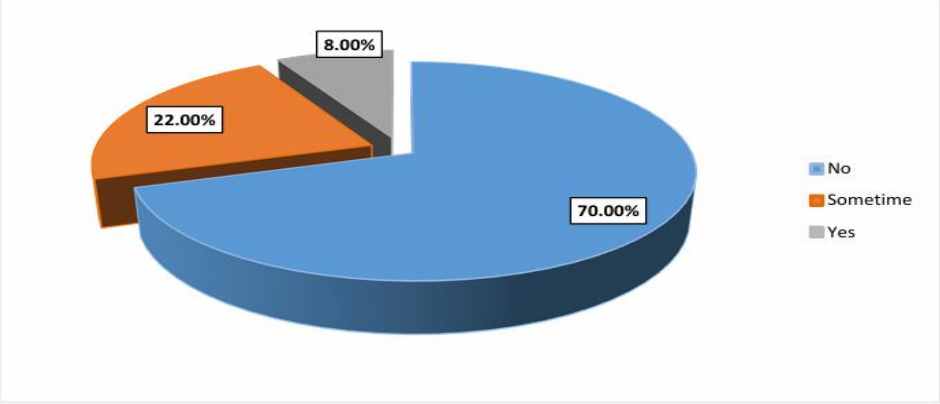

Fig 8. Distribution of responses to the question: Do you think applications can replace doctors?

Figure (8) shows that among the 50 participants who reported using reproductive health applications, the majority (70.00%) believed that applications cannot replace doctors. Meanwhile, 22.00% of respondents indicated that applications could sometimes serve as a substitute for doctors. Only 8.00% of participants believed that applications can fully replace medical professionals.

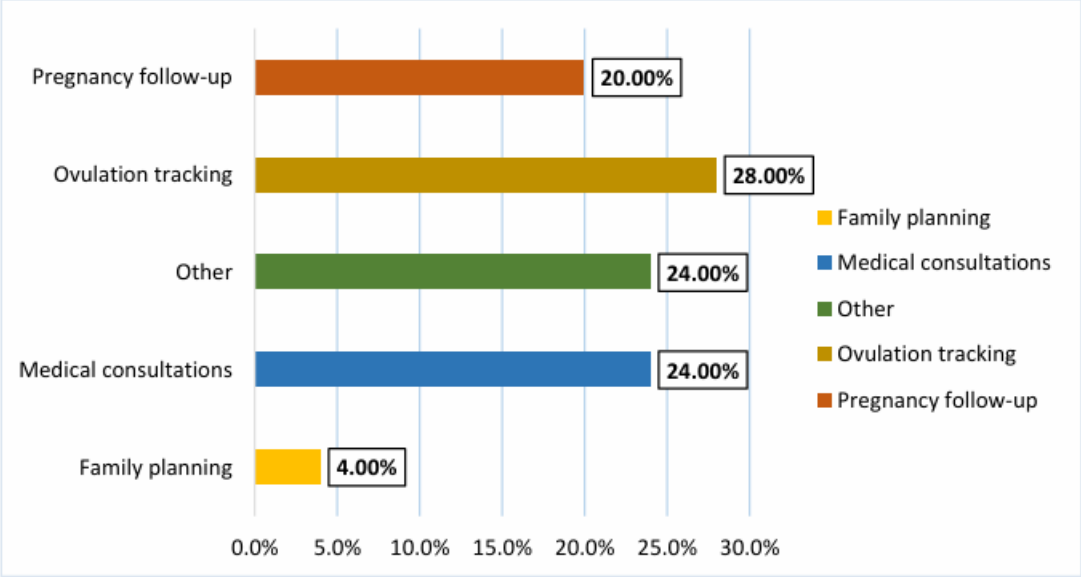

Fig 9. Distribution of responses to the question: if you use applications, what is the main purpose?

Figure (9) shows that Among the 50 perception who reported using reproductive health applications, the most common purpose was ovulation tracking, selected by 28.00% of users. this was followed by medical consultations and other purposes, each reported by 24.00% of participants. Pregnancy follow-up was cited by 20.00%, while family planning was the least common purpose, mentioned by only 4.00% of users

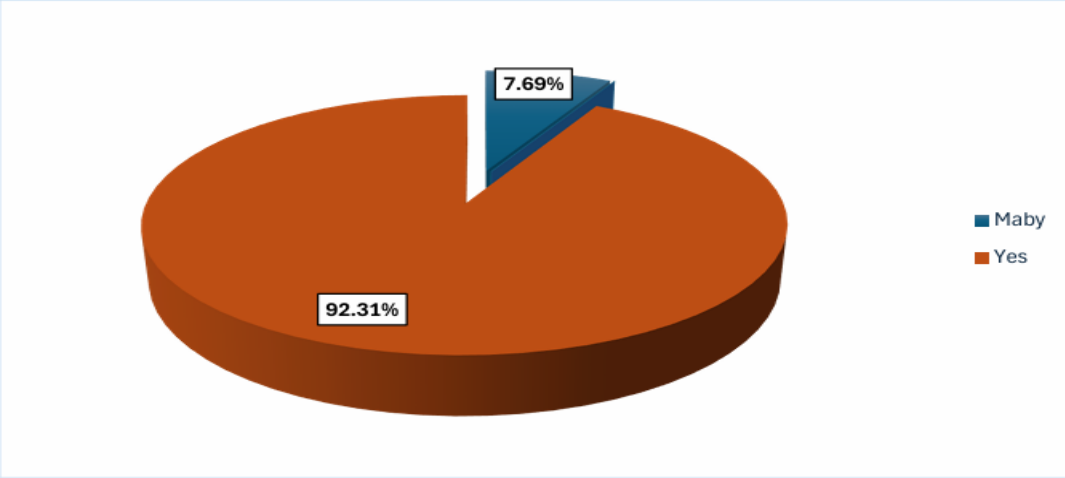

Fig 10. Distribution of if the gynecologist in the study believes that technology plays an effective role in educating and raising awareness about reproductive health among women

Figure (10) shows that the majority of gynecologists (92.31%) responded "maybe" when asked whether technology plays an effective role in educating and raising awareness about reproductive health among women. Only (7.69%) answered "yes".

4.Discussion

This study points out some real possibilities with digital health technology for reproductive health services in Libya. It also highlights certain limitations. A significant number of patients were aware of reproductive health applications, and more than half reported using them. The main perceived advantages included improved quality of care, easier access to information, and better communication with healthcare providers. These findings align with global literature emphasizing the role of digital tools in bridging healthcare gaps, particularly in fragile and post-conflict contexts [6]. However, several challenges were also identified. The primary concern was a lack of trust in the accuracy of information, followed by insufficient training and limited digital literacy. These observations are consistent with other studies which stress that technology can only be effective when users are confident and competent in its use [10]. Furthermore, most respondents stated that applications cannot fully replace doctors, underscoring the importance of a blended model in which technology complements traditional clinical care. Responses from gynecologists confirmed this pattern. Most relied on simple tools such as SMS or WhatsApp rather than specialized digital platforms, which reflects Libya’s current healthcare infrastructure and limited digital integration. Still, the optimism about future use of digital tools indicates a growing readiness for technological adoption, provided that investments are directed toward infrastructure, cybersecurity, and digital skill development [11].In summary, the findings suggest that technology holds significant

potential for enhancing reproductive healthcare in Libya. Yet its long-term success depends on addressing systemic barriers, strengthening women's awareness, and equipping healthcare professionals with the necessary skills [12].

5.Conclusion and Recommendations

This study looked into how technology plays a part in bettering reproductive health services in Libya. It zeroed in on awareness levels and usage patterns, along with the benefits and the challenges that come up. The results show that digital tools really offer a lot of potential here. Particularly mobile apps and telehealth setups seem to boost access to reproductive health info and services in good ways. Patients pointed out better care quality and easier access to health information as key upsides. Gynecologists backed that up too. They saw how these tools could raise awareness for women. Still, there are barriers that get in the way. Things like not trusting the tech enough, low digital skills, and poor infrastructure hold things back a lot. The findings point to some clear next steps for strategies. They should focus on building up digital health setups stronger. Awareness campaigns could help build women's trust in health apps. And integrating these digital tools into the current healthcare systems makes sense. Thing is, technology should not take over from regular doctor visits. It works best as a support in a mix of care models.

If these challenges get tackled, policymakers and health groups can make use of digital innovations. That would help create a tougher reproductive health system in Libya. In the end, it contributes to universal health coverage and better outcomes for moms and kids.

Limitations and recommendation:

This study has a few limitations worth pointing out. For one thing, we used convenience sampling. That means the results might not apply to all of Libya. The group we studied was pretty diverse. Still, it probably does not cover women in rural spots or places with less help. Those areas have tougher access to health care and tech. Next, everything came from self-reported surveys. People might forget details or say what sounds better. This happens a lot with personal topics like reproductive health. Then, we stuck to basic stats. No deeper tests to link tech use directly to health results. That limits what we can say about causes. Last, all the work happened in Tripoli spots. Other parts of Libya could be different. Infrastructure varies. So do cultural setups.

Looking ahead, future studies need bigger groups that really match the whole country. Bring in rural women too. Mix up the methods for better views on how women see these digital tools. Get into their thoughts and real health changes**.**

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[13] — (Reserved reference for research synthesis continuity in analysis; relates to cumulative conceptual framework of prior sources.)