

## **Swipe, Click or Flip? Learning Preferences for Pre-pregnancy Care Education among Young Women: A preliminary study**

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### **Abstract**

Pre-pregnancy care (PPC) reduces pregnancy and birth-related risks but remains underutilised, particularly among young Malaysian women. This study examines young women's preferences for digital and traditional health education environments to enhance engagement in PPC. A cross-sectional survey of 500 university females (ages 18–25) reveals a strong preference for digital platforms, mainly social media and mobile applications, while traditional formats such as printed materials and face-to-face sessions are also valued. The findings provide empirical evidence for developing culturally appropriate, theory-driven interventions that align with communication preferences. Integrating hybrid strategies can improve PPC awareness, health literacy, and maternal quality of life.

Keywords: Digital Health; Health Promotion; Preconception care; Quality of Life

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### **1.0 Introduction**

Women's reproductive health is a crucial aspect of their overall quality of life, encompassing their physical well-being, psychological health, autonomy, and empowerment in health-related decision-making (Whelan & Goodwin, 2023). The World Health Organisation recognises pre-pregnancy care (PPC) as a key intervention to enhance pregnancy outcomes and promote lifelong health for women and their offspring (Benedetto et al., 2024). PPC addresses health risks before conception, focusing on chronic disease management, nutritional supplementation, lifestyle modification, genetic counselling, and immunisation (Benedetto et al., 2024).

Despite its importance, awareness and uptake of PPC remain low in many settings, particularly among young reproductive-aged women in low- and middle-income countries. In Malaysia, for example, the maternal mortality ratio (MMR) has plateaued between 20 and 30 deaths per 100,000 live births over the past two decades, which does not meet the national target of fewer than 8.7 deaths per

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100,000 live births (Talib et al., 2018; WHO, 2025). This stagnation reflects persistent gaps in maternal healthcare services, underlining the need for proactive preventive strategies such as PPC.

University-aged women (18-25 years) represent a particularly strategic demographic for PPC interventions. This stage marks a critical window for establishing healthy behaviours before pregnancy, making interventions during this period more impactful. Additionally, university students tend to have higher levels of educational attainment and digital literacy, positioning them as ideal early adopters of digital health innovations that can later be scaled to broader populations. Despite these advantages, however, this group remains largely underserved by traditional PPC delivery models, which are typically limited to clinical encounters during pregnancy.

Many young women interact with health services only after pregnancy confirmation, which restricts opportunities for timely PPC (Holt et al., 2024). This reveals a critical gap in early education during the reproductive life course and highlights the need for innovative communication channels beyond traditional clinical settings. The convergence of digital technology adoption and persistent gaps in PPC awareness presents both a challenge and an opportunity. Young women's extensive engagement with digital platforms, particularly social media and mobile applications, offers unprecedented channels for health education delivery (Lutkenhaus et al., 2023). However, the effectiveness of PPC education fundamentally depends on delivery methods that align with young women's actual communication preferences and cultural contexts (Draper et al., 2019). Without empirical evidence on these preferences, health educators risk designing interventions that fail to engage their target audience, perpetuating low PPC awareness and missed opportunities for preventive care. This misalignment between health communication strategies and user preferences directly impacts women's reproductive health and quality of life by limiting their access to information necessary for informed health decision-making.

This study addresses the critical evidence gap regarding communication preferences for PPC education among young Malaysian women. Specifically, it aims to: (1) assess baseline awareness of PPC services among female university students, and (2) identify their preferences across digital and traditional communication channels for receiving PPC education. The findings will serve as an empirical foundation for developing culturally appropriate, theory-driven PPC interventions that align with the communication patterns of young Malaysian women.

## 2.0 Literature Review

### 2.1 Pre-pregnancy care awareness

Studies show that PPC awareness ranges widely, which is often linked to education and socioeconomic factors (Welshman et al., 2023). The limited integration of PPC into routine healthcare, along with sociocultural barriers, constrains its uptake in Southeast Asia (Ismail et al., 2025). Educational institutions, particularly universities, represent potentially powerful platforms for PPC education delivery due to their access to many young women during a critical life stage. However, research examining the specific needs, preferences, and barriers faced by university students in Malaysia regarding PPC remains limited, representing a significant gap in the evidence base needed to develop effective interventions.

### 2.2 Digital health communication preferences

Young women increasingly rely on digital platforms for health information. Social media platforms, such as TikTok and Instagram, dominate this landscape, offering accessible and engaging content for young adults (Lutkenhaus et al., 2023). Research affirms social media's positive influence on enhancing awareness and motivating health behaviour change (Saleem & Jan, 2025). Digital learning favours interactivity, multimedia, and personalisation. Mobile applications supporting goal setting, reminders, and two-way communication improve knowledge retention and behaviour adherence in pre-pregnancy health contexts (Ku et al., 2024). Despite digital benefits, risks include misinformation, limited critical appraisal skills, and the digital divide (Vissenberg et al., 2023).

### 2.3 Mobile health application in reproductive education

Mobile health applications specifically designed for reproductive health education demonstrate measurable clinical improvements. Meta-analyses reveal that mobile interventions enhance self-management, improve psychological well-being, and increase reproductive health knowledge compared to standard care approaches (Wei et al., 2023). These platforms may be more effective when incorporating evidence-based content, user-centred design principles, multimedia elements, and personalised feedback mechanisms. However, implementation challenges include ensuring data privacy, device security, and regulatory oversight (Logie et al., 2020). Malaysia's evolving digital health regulatory landscape highlights the need for robust frameworks that ensure content quality and user protection. Cultural sensitivities influence acceptance, necessitating contextually appropriate content and inclusive development processes that respect Malaysia's diverse religious and ethnic backgrounds.

### 2.4 Hybrid communication approaches

Hybrid educational models that combine digital tools with printed and face-to-face formats effectively accommodate diverse preferences and mitigate access disparities, particularly in Malaysia's multiethnic society and varied socioeconomic strata (Garba & Abdulhamid, 2024). The digital divide, characterised by unequal internet access and device ownership, disproportionately excludes rural, low-income, and marginalised women. Hybrid approaches help bridge these disparities through multi-modal delivery that accommodates varying digital literacy levels and infrastructure limitations. Healthcare providers have reported that digital resources complement, rather than

replace, face-to-face interactions, enabling more efficient consultations and ongoing support between appointments (Zammit et al., 2023).

### 2.5 Theoretical framework and research gap

This preliminary study is grounded in Human-centred Design principles, specifically the Design Thinking (DT) approach, to lay the empirical foundation for developing future interventions for PPC education. DT follows an iterative process that begins with empathy, which involves a deep understanding of the target users' experiences, needs, and challenges (Dam, 2025). The first phase, "Empathise," requires researchers to immerse themselves in users' worlds to understand how they naturally seek, consume, and engage with health information. This empathetic understanding forms the basis for accurately defining problems (Define phase), generating appropriate solutions (Ideate phase), creating prototypes (Prototype phase), and testing interventions (Test phase). See Fig. 1 below.

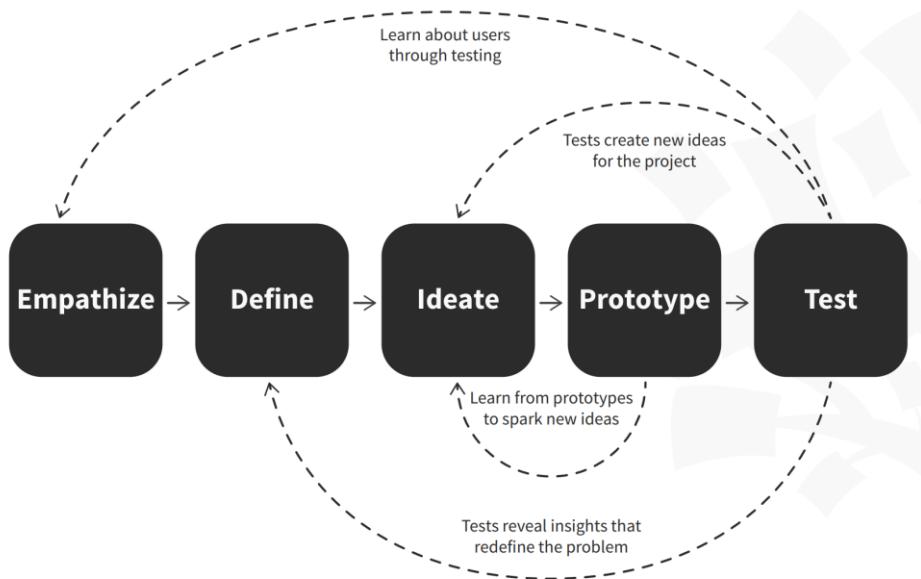


Fig. 1: Design Thinking Process  
(Source: Dam, 2025)

When applied to PPC education, DT necessitates a deep understanding of young women's communication ecosystems: the platforms they engage with daily, the content formats that capture their attention, and their preferred methods for receiving health information. Rather than assuming digital platforms are universally preferred or that traditional methods are outdated, this approach calls for empirical investigation into user preferences to inform evidence-based intervention design. By identifying these preferences, interventions can be tailored to maximise engagement, comprehension, and behaviour change, while respecting cultural contexts and addressing real-world constraints.

Rather than assuming digital platforms are universally preferred or that traditional methods are outdated, this approach calls for empirical investigation into user preferences to inform evidence-based intervention design. Despite increasing digital engagement among young Malaysian women, there is currently no empirical evidence identifying their preferred communication platforms or delivery formats for PPC education. Therefore, this study addresses that gap by exploring PPC awareness and communication preferences among young women in a university setting, providing baseline evidence for future "Empathise" phase of the DT process.

## 3.0 Methodology

### 3.1 Study design and setting

A cross-sectional survey was conducted between May and June 2023 among female undergraduate students at Universiti Teknologi MARA, Selangor Branch, Malaysia. The Selangor Branch, located in the Klang Valley region, serves as a major educational hub with students from across Malaysia, providing a reasonably representative sample of young Malaysian women pursuing higher education.

### 3.2 Participants

The study included 500 female undergraduate students aged 18–25 from 11 faculties representing diverse academic disciplines, including health-related and non-health-related fields. Inclusion criteria were being female, aged 18–25 years, unmarried, and enrolled as a full-time student. This age range was selected as it represents a critical period in reproductive health planning when PPC education

would be most beneficial and relevant for future pregnancy outcomes. The unmarried status criterion was applied as the study focused on pre-pregnancy.

### 3.3 Sampling and recruitment

A purposive sample of respondents was selected to ensure representation across both health-related and non-health-related academic programs. It enables strategic inclusion of diverse academic backgrounds within the university context, which is essential for understanding communication preferences across varying levels of health literacy and prior health education exposure.

The primary researcher distributed a self-administered, online, Malay-language questionnaire via Google Forms. Survey links were distributed via faculty WhatsApp groups after obtaining institutional consent. Participation was voluntary and anonymous. All mandatory questions in Google Forms were set as "required" to prevent missing responses.

### 3.4 Instrument

The questionnaire was developed in Malay through a comprehensive review of existing instruments measuring PPC awareness and communication preferences, followed by expert consultation with a public-health specialist to ensure content validity and contextual relevance. The final online questionnaire captured: (1) sociodemographic characteristics, (2) awareness of PPC services (yes/no), and (3) preferred communication environments for PPC education, including social media platforms (yes/no), online tools (yes/no), printed materials (yes/no), and face-to-face formats (yes/no). Participants who selected social media ranked five platforms (TikTok, Instagram, WhatsApp, Telegram, Facebook) by preference. Participants who selected online tools can choose multiple responses from mobile application, website, online course, live stream and e-book.

### 3.5 Data management and analysis

Raw data from Google Forms were extracted and imported into Microsoft Excel for initial screening. Data cleaning identified and addressed any duplicates. Cleaned data were imported into SPSS Version 25 for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated. Database access was restricted to authorised researchers only. Encryption measures were implemented to protect data. Regular backups were performed with secure storage in multiple password-protected locations. Data will be retained for five years in accordance with institutional policy, after which it will be securely destroyed.

### 3.6 Ethical consideration

The study received ethical approval from Universiti Teknologi MARA Research Ethics Committee with reference number 100 - FPR (PT.9/19) (FERC-03-23-06).

## 4.0 Findings

### 4.1 Sample characteristics and PPC service awareness

Table 1 shows participant's demographics and PPC service awareness. The sample comprised 500 female undergraduate students with a mean age of  $21.39 \pm 1.29$  years. Participants were predominantly Malay (94.8%) and from B40 income households (53.4%). Over half (53.8%) were enrolled in health-related programs, while 46.2% studied non-health disciplines.

Awareness of pre-pregnancy care services was reported by 251 participants (50.2%), indicating that approximately half the sample had prior knowledge of PPC. This finding is particularly concerning given that this population comprises university students with relatively high educational attainment, including 53.8% enrolled in health-related programs. The limited awareness even among this educationally advantaged group suggests systemic gaps in reproductive health education curricula and highlights the urgent need for proactive PPC education interventions targeting young women before their first pregnancy.

Table 1. Participant Demographics and Pre-pregnancy Care Service Awareness (N=500)		
Variables	Frequency, n (%)	Mean (SD)
Age		21.39 (1.29)
Faculty	Health Related	269 (53.8%)
	Non-Health Related	231 (46.2%)
Ethnicity	Malay	474 (94.8%)
	Bumiputera	26 (5.2%)
Household Income	B40	267 (53.4%)
	M40	189 (37.8%)
	T20	44 (8.8%)
PPC Service Awareness	No	249 (49.8%)
	Yes	251 (50.2%)

(Source: Author's own work)

### 4.2 Communication preference patterns

Table 2 and Figure 2 illustrate the overall preference distribution across communication modalities, revealing a hybrid preference model. Digital platforms dominated, with 95.8% preferring social media and 94.2% preferring online tools. However, traditional methods maintained strong support: 77.6% preferred printed materials and 69.4% preferred face-to-face formats. This pattern suggests that

participants value multiple complementary channels rather than viewing digital and traditional approaches as mutually exclusive.

Table 2. Pre-pregnancy Care Communication Preferences

Variables		Frequency, n (%)
Social Media Preference	No	21 (4.2%)
	Yes	479 (95.8%)
Social Media Platform (First Choice)*	Tik Tok	268 (55.9%)
	Instagram	126 (26.3%)
Online Tool Preference	Whatsapp	89 (18.6%)
	Telegram	56 (11.7%)
Online Tools Selected (Multiple responses)**	Facebook	30 (6.3%)
	No	29 (5.8%)
Printed Materials Preference	Yes	471 (94.2%)
	Mobile application	323 (68.6%)
Face-to-face Preference	Website	321 (68.2%)
	Online course	230 (48.8%)
Printed Materials Preference	Live stream	197 (41.8%)
	E-book	181 (38.4%)
Face-to-face Preference	No	153 (30.6%)
	Yes	347 (69.4%)
Face-to-face Preference	No	112 (22.4%)
	Yes	388 (77.6%)

\*Among those who selected social media preference (n = 479)

\*\* Among those who selected online tool preference (n = 471)

(Source: Author's own work)

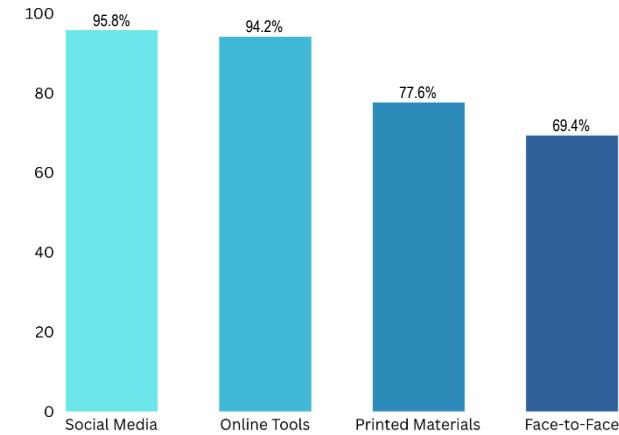


Fig. 2: Distribution of preferred communication modalities for PPC education  
(Source: Author's own work)

#### 4.3 Digital communication preferences

Digital platforms dominated communication preferences, with 94.2% of respondents favouring online tools for PPC education. This near-universal preference suggests strong potential for digital health interventions. Mobile applications were most preferred (68.6%), followed closely by websites (68.2%). This preference likely reflects the convenience of accessing health information through familiar mobile interfaces. The minimal difference between mobile application and website preferences suggests that participants value both dedicated applications and web-based resources, possibly for different purposes or contexts. Websites may be preferred for more comprehensive information seeking, whilst applications might be favoured for regular engagement and reminders. E-books showed the lowest preference among digital formats at 38.4%, possibly reflecting preferences for more interactive and multimedia-rich content formats over traditional text-based resources, even in digital form. Social media platforms showed near-universal appeal (95.8%), with distinct platform preferences emerging: TikTok was the primary choice (55.9%), followed by Instagram (26.3%), WhatsApp (18.6%), Telegram (11.7%), and Facebook (6.3%). Facebook is the least preferred suggesting declining popularity among younger demographics despite its historical significance in social media adoption. This finding aligns with broader trends showing younger users migrating towards newer platforms.

#### 4.4 Traditional communication preferences

Despite strong digital preferences, 77.6% of participants valued printed materials, and 69.4% preferred face-to-face formats. Several factors explain this preference for traditional channels.

Printed materials offer permanent, shareable references that require no technology, conveying credibility and official endorsement from healthcare institutions. A face-to-face preference reflects the value placed on personalised communication, immediate clarification opportunities, and trust established through direct interaction with a healthcare provider, particularly important for sensitive reproductive health topics where cultural norms influence comfort levels.

Traditional formats remain essential for contexts with limited digital infrastructure, internet connectivity issues, or varying digital literacy levels, relevant considerations in Malaysia's diverse socioeconomic landscape. Rather than replacing digital channels, traditional formats serve complementary roles: face-to-face consultations for personalised counselling, and printed materials for family sharing and offline reference.

## 5.0 Discussion

### 5.1 Summary of key findings

This study highlights clear preferences among young Malaysian women for digital platforms in PPC education, primarily social media, with TikTok emerging as the most favoured, as well as online tools such as mobile applications and websites. Nevertheless, participants continued to value printed materials and face-to-face sessions, indicating that digital and traditional approaches are complementary rather than competing. Despite over half of respondents being enrolled in health-related programmes, only half were aware of PPC services, signalling an educational gap even within an educated demographic. These findings suggest the need for hybrid, preference-aligned strategies to expand PPC awareness cost-effectively across diverse socioeconomic groups.

The overwhelming preference for digital communication channels likely reflects the ubiquity and convenience of smartphones and internet access among university students. TikTok's dominance can be particularly attributed to its short-form, visually engaging, and

algorithm-driven content delivery, which effectively captures and sustains attention among younger demographics. Mobile applications, favoured by the majority, offer personalised, interactive, and on-demand health information, making them suitable for ongoing engagement with PPC content. Websites, online courses, and live-streamed formats also received substantial support, indicating openness to diverse digital educational modalities. These platforms can complement each other, serving distinct roles ranging from comprehensive information repositories to interactive, real-time learning experiences. However, despite the strong digital inclination, nearly 78% of participants preferred printed materials, and nearly 70% valued face-to-face education. This sustained preference suggests that tangible, easily accessible resources and interpersonal communication remain important, possibly due to perceptions of credibility, trust, and ease of use, which are particularly important in areas with varying digital literacy or internet access challenges.

### *5.2 Theoretical interpretation of findings*

The communication preferences observed in this study provide a solid foundation for future intervention development using the DT approach. This preliminary study generates empirical evidence about users' behaviours and contexts, insights that will inform the Empathise phase when DT is applied in subsequent intervention development. The hybrid preference model, which combines strong digital adoption with sustained value in traditional formats, reveals important insights about how young women conceptualise health information seeking.

### *5.3 Implications*

#### *5.3.1 Practice implications*

Health educators should leverage short-form visual storytelling (e.g., TikTok, Instagram Reels) to deliver concise PPC messages and use mobile-app features such as reminders, personalised dashboards, and gamified elements to maintain engagement. Printed and face-to-face resources should be retained for credibility, personal counselling, and users with limited internet access. Embedding digital health literacy modules can help young women critically evaluate online information.

#### *5.3.2 Policy implications*

Embedding PPC education within national health strategies and reproductive health services, such as premarital courses and premarital HIV testing, offers significant opportunities to institutionalise awareness and uptake. Digital health policies must prioritise the regulation and quality assurance of mobile applications to safeguard data privacy, ensure content accuracy, and build user trust. Investments in digital infrastructure and internet accessibility, particularly targeting rural and lower-income communities, are crucial to prevent the exacerbation of health inequities. Equity-focused policy frameworks aim to reduce the digital divide, ensuring educational innovations benefit all population segments.

#### *5.3.3 Equity implications*

Digital exclusion remains a critical concern. Women in lower socioeconomic groups or underserved regions risk being marginalised if digital health initiatives fail to account for access and literacy barriers. Programme developers should prioritise culturally tailored content and engage community stakeholders to foster acceptance and relevance, ensuring that digital advancement does not widen existing health disparities.

### *5.4 Scalability and sustainability*

The hybrid approach is adaptable across Malaysian states and potentially across Southeast Asia with localisation. Partnerships with state health departments and universities can facilitate nationwide implementation. Sustainability requires embedding PPC education within existing health system structures, rather than in standalone projects, to ensure continuity beyond initial funding periods.

### *5.5 Ethical considerations*

Digital privacy and security are paramount for reproductive health applications handling sensitive personal data. Applications must implement robust data protection measures complying with Malaysia's Personal Data Protection Act, including encryption, secure storage, transparent privacy policies, and explicit user consent procedures. Data should never be shared without consent.

### *5.6 Strengths and limitations*

Strengths include a large sample size and a granular preference profile across communication channels and platforms. Limitations include single-institution purposive sampling, which limits generalisability beyond university populations. University students generally possess higher educational attainment and digital literacy than the broader population of young Malaysian women, which may lead to an overestimation of digital platform preferences. Consequently, the findings may not accurately reflect the preferences of non-university women, lower-income groups, or married women. The predominance of Malay participants (94.8%) further limits insights across Malaysia's diverse ethnic communities. The cross-sectional design captures preferences at a single time point and does not permit causal inference. Self-reported preferences may not predict actual usage patterns, as stated preferences do not always translate into sustained engagement. Finally, the binary awareness measure does not capture the depth of knowledge.

## 6.0 Conclusion & Recommendations

This study highlights the strong preference of young Malaysian women for digital platforms, particularly mobile applications and social media, in their pursuit of PPC education. It reveals that traditional communication methods such as printed materials and face-to-face sessions retain significant value within the digital-first landscape. These findings contribute to quality-of-life research by identifying communication preferences that enhance young women's access to reproductive health information, supporting their autonomy in health decision-making and reproductive planning. These findings provide empirical justification for developing a future PPC intervention using the DT approach, ensuring that intervention development is grounded in actual user preferences rather than assumptions. By aligning PPC education with identified preferences, interventions may improve awareness, knowledge acquisition, and service utilisation, ultimately contributing to enhanced maternal health outcomes.

### 6.1 Recommendation for healthcare providers and educators

Healthcare providers and educators should prioritise developing engaging, interactive PPC education content optimised for mobile apps and social media platforms favoured by young women. Simultaneously, maintaining complementary traditional education materials and personal counselling is critical to address varied learning needs and bridge digital access gaps. Integrating digital literacy training can empower users to navigate and utilise digital health resources effectively.

### 6.2 Recommendation for policymakers

Policy frameworks should incorporate PPC education within national health agendas, including premarital courses and reproductive health screenings such as HIV testing. Establish regulatory and data-protection standards for PPC mobile applications in line with Malaysia's Personal Data Protection Act. Expand digital infrastructure and equitable access to mitigate the urban-rural and socioeconomic digital divide.

### 6.3 Recommendation for researchers

Addressing the single-institution limitation and Malay predominance, conduct multi-site studies across diverse ethnic groups with various socioeconomic backgrounds, including rural communities, to validate the generalisability of the preference. Given the limitation of the cross-sectional design, employing longitudinal studies to track whether stated digital preferences predict actual, sustained usage patterns over time would be beneficial. Measure PPC knowledge, attitude, and perception beyond the binary awareness measure to capture the depth of understanding. Building upon these preliminary findings, future intervention development should adopt the DT approach to develop a culturally appropriate PPC mobile health application. Conduct randomised controlled trials to evaluate the effectiveness of interventions on awareness, knowledge, behaviour change, and pregnancy outcomes, addressing the current study's inability to establish causation.

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The authors gratefully acknowledge all the participants who took part in this study by generously sharing their time and responses.

## Paper Contribution to Related Field of Study

This study makes four contributions to the field of pre-pregnancy health and digital health promotion. First, it addresses a major evidence gap by documenting awareness and communication environment preferences for PPC among young adult women in Malaysia. Second, it highlights the growing importance of digital communication environments, particularly TikTok, and mobile applications, as preferred sources of health information, while demonstrating the continued relevance of traditional methods. Third, as a preliminary study, it provides empirical justification for a subsequent protocol to design and validate a culturally adapted, theory-driven PPC mobile health application using human-centred design. Finally, it advances the application of Precision Public Health principles by proposing hybrid strategies that integrate digital delivery with existing offline entry points such as premarital courses and premarital HIV screening. Together, these contributions support innovation in maternal health promotion and policy development.

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