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Cross-sectional Study on Health-seeking Behavior and Barriers to Perceived Usability of Medication Tracker among Middle-aged Adults in a Community in Marikina City

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ABSTRACT

Background and Objectives. Technological advancements are reshaping healthcare, particularly through mobile health (mHealth) applications that aid chronic disease management. Medication tracking apps, such as Simpill, have shown potential in improving outcomes for conditions like hypertension. However, disparities in digital literacy and concerns related to technology acceptance and privacy may hinder effective use. Grounded in the principles of the Design Thinking approach, this study sought to evaluate the relationship between health-seeking behavior (HSB), perceived barriers (PB), and the perceived usability (PU) of Simpill among middle-aged hypertensive adults. The research aimed to capture not only measurable associations but also to inform future app development through a user-centered lens that prioritizes empathy and real-world usability.

Methods. A quantitative, descriptive-correlational research design was employed to assess respondents' HSB, PB, and PU related to Simpill. The study was guided by core phases of the Design Thinking framework, particularly empathize and define, to ensure a deep understanding of user needs and usability constraints. Data were collected using a four-part, researcher-modified questionnaire administered to 138 purposively selected middle-aged adults (30–59 years old) residing in Barangay Industrial Valley, Zone 6, Marikina City, Philippines. All participants had a confirmed diagnosis of hypertension. Correlational analyses, including Kendall's Tau B, were conducted to examine relationships among the variables. The integration of Design Thinking informed the development and interpretation of questionnaire items, aligning them with real-world challenges experienced by the target users.

Results. The study investigated the relationship between HSB, PB, and the PU of Simpill among 138 middle-aged hypertensive individuals. Most respondents were female (55.8%), aged 50–59 (47.8%), and employed in non-health-related sectors (95.7%). HSB levels were generally high (mean = 3.23), particularly in actively seeking health information, while lower engagement was noted in routine vital sign monitoring. PB were moderate (mean = 2.06), with unfamiliarity with the application cited as a common issue. PU was also rated as moderate (mean = 2.80), although ease of use received a low score (mean = 1.99). A weak positive correlation was found between HSB and PU (Kendall's Tau B = 0.123, p = 0.049), while a moderate negative correlation existed between PB and PU (Tau B = -0.402, p <0.001). These findings reflect insights derived from the Design Thinking "empathize" phase, suggesting that while proactive health behaviors may modestly support app engagement, unresolved user pain points—such as poor usability and lack of

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familiarity—remain significant obstacles to adoption. The results underscore the importance of moving to the "ideate" and "prototype" phases, where such user insights can directly shape the redesign and improvement of mHealth tools.

Conclusion. The study identified a high level of health-seeking behavior, reflecting the respondents' engagement with their health and openness to guidance, consistent with the user-empathy foundation of Design Thinking. Moderate perceived barriers highlight existing challenges in technology adaptation, particularly among those who prefer traditional methods. The moderate PU rating of Simpill, especially in terms of ease of use, suggests the app's current design does not fully align with user capabilities or expectations. In line with Design Thinking principles, particularly user-centered innovation, the findings emphasize the need to involve users in iterative co-design processes to improve mHealth solutions. Addressing perceived barriers through enhanced digital literacy, usability testing, and interface refinement could substantially boost app acceptance and effectiveness in real-world settings.

Keywords: mHealth, hypertension, mobile applications, health behavior, technology acceptance, user-centered design

INTRODUCTION

The rapid integration of technological innovations across various sectors has transformed healthcare delivery, with mobile health (mHealth) applications emerging as essential tools for health monitoring, disease diagnosis, and chronic disease management. In recent years, the proliferation of health-related mobile applications has empowered individuals to take an active role in their well-being. In the Philippines, approximately 74 million individuals use smartphones, providing access to more than 43,000 health-related applications.[1] Despite this widespread ownership, several contextual barriers prevent the optimal utilization of digital health tools. A persistent digital divide—characterized by unequal access to internet connectivity, differences in digital literacy, and economic challenges—continues to limit the effectiveness and inclusivity of mHealth interventions.[2]

Key obstacles to mHealth adoption in low- and middle-income countries (LMICs), including the Philippines, include limited infrastructure, low digital literacy, and socio-economic constraints. In many rural and geographically isolated areas, the internet infrastructure remains inadequate, resulting in poor connectivity that impedes the effective use of health applications.[3] Digital literacy also varies greatly across demographic groups; older adults, individuals with lower education levels, and residents of rural communities often lack the skills necessary to operate mobile health technologies.[4] Furthermore, the costs associated with mobile devices, internet access, and paid application features restrict the use of these tools among economically disadvantaged populations.[5] Cultural factors, such as a preference for traditional medicine or skepticism toward digital interventions, may also reduce user engagement.[6] These multifaceted barriers emphasize the need for user-centered, context-sensitive approaches to mHealth development and deployment to ensure accessibility and sustained usage.

Hypertension remains one of the most significant global public health challenges, affecting over 1 billion people worldwide and accounting for an estimated global prevalence of 32%.[7] In the Philippines, hypertension continues to be one of the leading causes of morbidity and mortality, contributing significantly to complications such as stroke, coronary artery disease, heart failure, and chronic kidney disease.[8] Standard management of hypertension includes lifestyle modifications and long-term pharmacologic interventions, where medication adherence is essential to achieving optimal health outcomes.[9,10] Given the chronic nature of hypertension and the need for long-term patient engagement, mHealth applications are increasingly being investigated for their potential to support treatment adherence and reduce the burden on healthcare systems.[11]

Previous studies suggest that mHealth tools can enhance clinical outcomes by increasing patient engagement, enabling self-care, and improving treatment compliance.[12] Health-seeking behavior (HSB), which refers to the actions individuals take to maintain or improve their health status, has been shown to benefit from digital interventions, particularly those that provide personalized guidance and timely information.[13] Online health information-seeking behaviors, in particular, are associated with better adherence to treatment plans and more proactive health decision-making.[14] On the other hand, low engagement with mHealth tools has been associated with poorer health outcomes, especially among patients managing chronic conditions like hypertension.[13]

A notable mHealth tool is the Simpill application—a digital medication adherence platform that supports users through reminders sent via SMS or push notifications and enables real-time updates for caregivers and healthcare providers. By tracking missed or delayed doses and promoting consistent medication intake, Simpill has been effective in managing chronic conditions such as hypertension, tuberculosis, and HIV.[15] Its ability to reinforce medication adherence and facilitate collaborative monitoring makes it a potentially powerful tool in improving patient outcomes and reducing healthcare costs.

To understand the contextual factors that affect the usability of such tools, this study adopted the Design Thinking approach as its theoretical framework. Design Thinking is a human-centered, iterative methodology that emphasizes empathy, ideation, prototyping, and testing as part of the solution development process.[16] It is especially relevant in digital health research because it facilitates a deeper understanding of users' lived experiences and the sociocultural and technical factors that influence their interaction with technology.[17] In the context of this study, Design Thinking informed the construction of user-centered research questions and guided the interpretation of findings beyond surface-level statistics.

The relevance of the Design Thinking framework is further supported by emerging literature. For example, Altman et al. used Design Thinking to redesign a mobile platform for HIV care, resulting in enhanced usability, higher patient engagement, and more tailored health content.[18] Likewise, Ospina-Pinillos et al. utilized participatory design methodologies in developing a mental health eClinic aimed at enhancing access to and quality of mental health care for young people, resulting in improved usability and user engagement.[19] These studies demonstrate that solutions rooted in user empathy and iterative feedback loops are more likely to succeed across diverse populations, particularly those facing digital and healthcare access challenges.

Guided by this framework, the present study aimed to examine the relationship between health-seeking behavior, perceived barriers, and perceived usability of the Simpill medication tracking app among middle-aged adults with hypertension. Specifically, the study sought to determine whether health-seeking behavior is associated with respondents' demographic profiles—such as age, education, and existing chronic conditions—and whether these profiles similarly affect perceptions of the app's usability. Furthermore, the study investigated the relationship between perceived barriers and usability, recognizing that practical challenges such as limited digital literacy or app complexity may diminish a user's engagement. By embedding empathy and iterative understanding into the study design, the research advances a more holistic view of mHealth adoption. It highlights the importance of interpreting behavioral and perceptual patterns as reflections of real-world user needs and challenges—critical considerations when designing tools for chronic disease management.

Ultimately, this study aims to generate user-centered insights that can inform future stages of mHealth development, particularly the ideation and prototyping phases of Design Thinking. Through this approach, it is possible to co-create digital health solutions that are not only technologically sound but also culturally appropriate, accessible, and aligned with the expectations and abilities of target users.[20] By integrating these principles, the research contributes toward closing the gap between digital health innovation and actual community-level adoption.

MATERIALS AND METHODS

Study Design

This study employed a cross-sectional analytical design, a widely used epidemiological approach suitable for examining relationships among multiple variables within a population at a single point in time.[15] This design was particularly appropriate for achieving the study's objective of capturing current patterns in health-seeking behavior (HSB), perceived barriers (PB), and perceived usability (PU) of a medication tracker application among middle-aged adults in Marikina City, Philippines. By using this design, the researchers were able to obtain a snapshot of participants' behaviors, perceptions, and attitudes toward mobile health (mHealth) applications, without introducing interventions or altering the environment—thus preserving the natural context of the variables being examined.[16]

To incorporate a user-centered lens, the study also drew upon elements of the Design Thinking approach during data interpretation and problem-framing phases.[17] This human-centered methodology enabled the researchers to better understand and empathize with users' experiences with mHealth tools, define key usability and behavioral challenges, and identify potential opportunities for solution development aligned with the real needs and lived contexts of the target population.[18]

The application of a quantitative descriptive-correlational method further complemented the cross-sectional design and the exploratory nature of Design Thinking. Through structured questionnaires, the researchers quantified HSB, PB, and PU, and employed statistical correlation analyses to assess the strength and direction of the relationships among these variables.[19] The integration of Design Thinking principles enriched the interpretation of these quantitative findings by highlighting user-driven insights, thereby supporting a more comprehensive understanding of mHealth usability. Overall, the combination of research design, analytical method, and human-centered framework offered a practical and statistically robust approach to examining factors influencing mHealth use—establishing a foundation for future longitudinal, interventional, or co-design studies.[20]

Setting and Participants

Marikina City, one of the 16 cities and municipalities in Metro Manila, Philippines, served as the study site. According to the 2019 Philippine Health Statistics published by the Department of Health, the city recorded 1,376 deaths due to heart disease, ranking fourth in cardiovascular-related mortality within Metro Manila. Notably, Marikina had the highest mortality rate among all Metro Manila cities, at 288.3 per 100,000 population, underscoring the significant burden of cardiovascular disease in the area.[21] The Centers for Disease Control and Prevention (CDC) identify hypertension as a primary risk factor for cardiovascular diseases.[22]

Marikina is uniquely positioned among local government units (LGUs) for its early and active adoption of digital infrastructure and mobile technology. The city has invested in enhancing internet connectivity and has consistently ranked high in local governance performance, particularly in health and ICT innovation. A city ordinance—Marikina City Ordinance No. 065, Series of 2018—supports the integration of information and communications technology (ICT) in public service delivery, indirectly encouraging the use of mobile phones for health-related purposes.[23] This ordinance promotes e-governance and incentivizes citizen engagement through digital platforms.

Moreover, Marikina residents demonstrate relatively high digital literacy and smartphone penetration compared to other Metro Manila cities. According to a report from the Department of Information and Communications Technology, urban areas like Marikina show “higher digital inclusion readiness” due to stronger infrastructure, higher education levels, and supportive public-private partnerships.[24] This digital readiness makes Marikina especially suitable for mobile health (mHealth) interventions targeting chronic diseases such as hypertension. The Philippine eHealth Strategic Framework and Plan 2023–2028 further supports this approach, stating that mHealth technologies are encouraged in urban communities to “promote health-seeking behaviors and improve chronic disease surveillance through mobile applications and SMS-based interventions.”[25]

The study participants were residents of Barangay Industrial Valley, Zone 6, Marikina City, aged 30 to 59 years, with a confirmed diagnosis of hypertension. However, the study did not capture specific data on the total number of participants (N) or details regarding their antihypertensive regimens—such as whether they were prescribed monotherapy or combination therapy. This is a notable limitation, as hypertensive patients are frequently prescribed multiple medications to achieve optimal blood pressure control.[26,27] Participant recruitment was conducted from April 18 to June 4, 2023, followed by data collection from June 5 to June 22, 2023.

Sample Size

The required sample size for this study was calculated using G*Power 3.1.9.7 software, based on a two-tailed Pearson correlation analysis, with the following parameters: effect size (r) = 0.30 (medium effect), alpha level (α) = 0.05, power ($1 - \beta$) = 0.80, and a critical value of 0.197. This yielded a minimum required sample size of 138 respondents to detect statistically significant relationships between variables.[28]

To ensure the relevance and appropriateness of the study population, purposive sampling was employed. This non-probability sampling technique was selected to target middle-aged adults (aged 30–59 years) residing in Marikina City who had a clinically confirmed diagnosis of hypertension. The purposive approach ensured that participants possessed the specific characteristics necessary to address the study's objectives—particularly in assessing health-seeking behavior, perceived barriers, and perceived usability of a medication tracking mobile application.[29]

Participants in this study were limited to middle-aged adults aged 30 to 59 years, a demographic chosen to align with the research objectives and the clinical context of hypertension—the chronic condition under investigation. This age group was selected due to the higher prevalence of hypertension within this population and the increased likelihood of being prescribed long-term maintenance medications, making them a particularly relevant cohort for evaluating the usability and perceived barriers of mobile health (mHealth) interventions.[30] The decision to focus on this age range also allowed for the inclusion of individuals with varying degrees of digital literacy and technology usage, which was essential for assessing real-world engagement with the Simpill application.[31]

During participant recruitment, the inclusion and exclusion criteria were rigorously applied to ensure a consistent and clinically appropriate sample. The inclusion criteria required participants to have a confirmed diagnosis of hypertension, operationalized using the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines, which define hypertension as a systolic blood pressure of ≥130 mmHg or a diastolic pressure of ≥80 mmHg.[32] Recruitment took place through a community-based, purposive sampling approach involving house-to-house visits and participation in organized small-group and one-on-one health consultations. Local health workers and barangay personnel assisted in identifying potential participants who had either previously been diagnosed with hypertension by a physician or had elevated blood pressure readings documented in community health center records.

To verify eligibility, each prospective participant was asked to present documentation of a previous hypertension diagnosis or undergo a blood pressure screening during recruitment. Measurements were taken using calibrated digital sphygmomanometers, and those who met or exceeded the ACC/AHA diagnostic thresholds were considered eligible for inclusion. This application of the ACC/AHA criteria ensured that the sample accurately reflected individuals actively managing or at risk of managing chronic hypertension and medication adherence challenges.

Exclusion criteria were also clearly defined and consistently applied. Individuals were excluded if they relied exclusively on traditional, non-digital methods of medication tracking—such as pillboxes, handwritten calendars, or verbal reminders—or if they had already established effective personal systems for medication adherence that did not involve or require technological support. Furthermore, any individual who declined to give informed consent was not included in the study. This careful selection process ensured that the study population was both clinically appropriate and technologically relevant to the aims of the research, thereby increasing the validity of the findings related to mHealth usability and adoption.

Instruments

The research instrument used in this study was structured into four distinct sections. The first section gathered demographic data through a multiple-choice format, collecting information on participants’ age, sex, educational attainment, type of profession, and combined gross family income. These variables provided essential context for interpreting findings and improving sample representation. Professions were categorized into health-allied and non-health-allied groups, while income brackets were consolidated to reflect varying levels of medication affordability.[33]

The second section utilized a modified Health-Seeking Behavior (HSB) questionnaire, adapted from the instrument developed by Masiye and Kaonga and aligned with the Health Service Utilization Model.[34] Items unrelated to the study's focus—such as those concerning diabetes mellitus—were excluded to ensure relevance. Responses were rated using a four-point Likert scale: (1) Never, (2) Rarely, (3) Sometimes, and (4) Always/Often. The absence of a neutral midpoint was intentional, designed to encourage more decisive responses and enhance the reliability of the data collected.

The third section assessed perceived barriers (PB) to using mobile health (mHealth) applications. It was developed using selected items from instruments created by Zhou et al. and Sauro, which were modified to reflect the context of Simpill, the medication tracker featured in this study.[35,36] This section also employed a four-point Likert scale: (1) Strongly Disagree, (2) Disagree, (3) Agree, and (4) Strongly Agree.

The fourth section evaluated the perceived usability (PU) of the Simpill medication tracker, drawing from the psychometric principles established by Nunnally.[37] To improve accessibility and respondent comprehension, the instrument was translated into Filipino and validated by a Filipino language expert. The same four-point Likert scale used in the PB section was applied here.

Each adapted questionnaire underwent expert validation. The HSB instrument was reviewed by three nursing specialists and two physicians. The PB questionnaire was validated by three nursing faculty and two informatics experts. The PU section was assessed by three nursing experts and two psychologists. The Filipino translations were evaluated by a professional linguist to ensure accuracy and appropriateness.

Following expert review, the instruments were subjected to pilot testing involving 13 respondents who matched the study's target population. Reliability testing was conducted using JAMOVI software, with internal consistency measured by Cronbach's alpha. Results indicated "Excellent" reliability for the HSB scale ($\alpha = 0.902$), "Acceptable" for PB ($\alpha = 0.793$), and "Good" for PU ($\alpha = 0.802$). Overall, the instrument demonstrated "Good" internal consistency, with a composite Cronbach's alpha of 0.832.[38]

Data Collection

Figure 1 illustrates the flow diagram detailing participant recruitment, engagement with the Simpill medication tracker, and the data collection process conducted in Marikina City, Philippines (April–June 2023). Participant recruitment occurred between April 18 and June 4, 2023, within a designated barangay in Marikina City. In alignment with the empathize phase of the Design Thinking approach, the research team collaborated with barangay health workers (BHWs) and community volunteers who had deep familiarity with the residents' health conditions and sociocultural contexts.[39] These frontline personnel played a key role in identifying eligible participants—specifically, adults aged 30 to 59 years with a clinically confirmed diagnosis of hypertension, verified through barangay health records or supporting medical documentation. Recruitment strategies included house-to-house visits and community-based gatherings aimed at building rapport and trust. Both small-group and one-on-one formats were used to provide personalized communication and ensure participant ease and engagement.

Once identified, potential participants were individually approached and provided with both written and verbal explanations of the study. These information sessions, rooted in the empathize and define stages of Design Thinking, offered a clear overview of the study's objectives, procedures, estimated time commitment, potential risks and benefits, and participants' rights—including the right to refuse participation or withdraw at any point without consequence. A standardized informed consent script was used to ensure consistency and clarity across sessions. Trained research team members encouraged open dialogue and responded to inquiries, promoting a respectful and transparent consent process. Voluntary written informed consent was obtained from all participants prior to enrollment.

Data collection occurred from June 5 to June 22, 2023. Participants were first introduced to Simpill, the mobile application used in the study for medication tracking. As part of the prototype and test phases of Design Thinking, participants were encouraged to use the app consistently for a two-week period in their natural environment. Orientation sessions were delivered in person and included step-by-step demonstrations on downloading, navigating, and utilizing the app. Research staff provided technical support and follow-up consultations to address challenges and promote app integration into participants' daily routines. This user engagement phase was essential for capturing real-time feedback on functionality, relevance, and usability.[40]

Following the two-week app usage period, participants completed a self-administered pen-and-paper questionnaire composed of four sections: (1) demographic and health-related data, (2) Health-seeking Behavior (HSB), (3) Perceived Barriers (PB) to mHealth use and healthcare access, and (4) Perceived Usability (PU) of the app. Questionnaire items were derived from prior qualitative findings and organized around user-centered themes identified in the define phase of the Design Thinking model.[41] Data collection was conducted in private, community-based venues such as barangay health centers to ensure confidentiality and convenience. Trained research assistants were available to provide neutral guidance and clarification as needed. All participants completed the questionnaire independently, with the research team ensuring that ethical principles of autonomy, confidentiality, and respect were upheld throughout the study.[42]

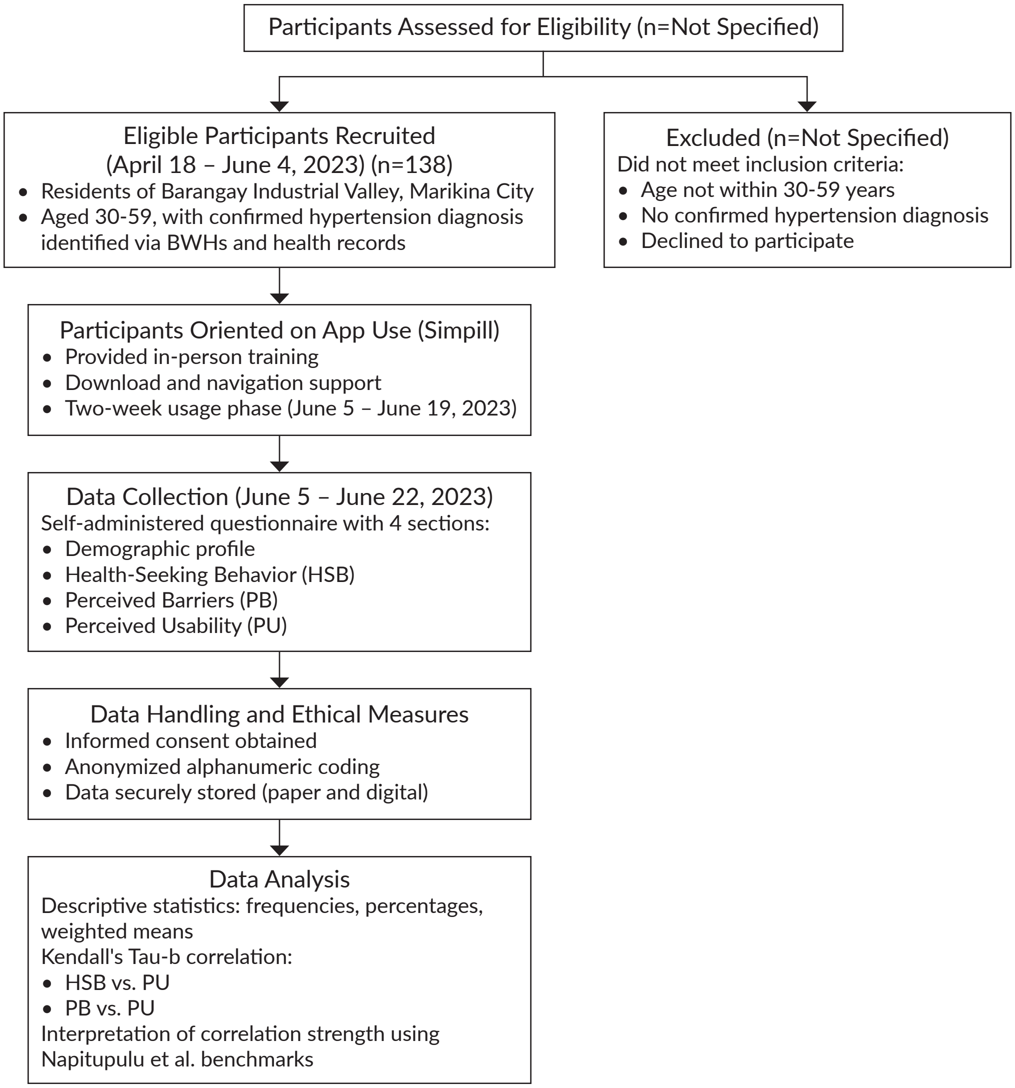

Figure 1. Flow diagram showing participant recruitment, engagement with the Simpill medication tracker, and data collection process in Marikina City, Philippines (April–June 2023).

Data Analysis

Data were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics, including frequencies and percentages, were used to summarize the sociodemographic characteristics of the respondents. Weighted means were computed to determine overall levels of Health-seeking Behavior (HSB), Perceived Barriers (PB), and Perceived Usability (PU) of the Simpill medication tracker.

Responses were measured using a four-point Likert-type scale (1 = Strongly Disagree to 4 = Strongly Agree). To facilitate interpretation, categorical thresholds were established based on adapted benchmarks from validated psychological measurement research (e.g., Kroenke et al.): mean scores ranging from 1.00 to 2.00 were interpreted as low, 2.01 to 3.00 as moderate, and 3.01 to 4.00 as high.[43]

To examine relationships among key variables, Kendall's Tau-b correlation coefficient was employed. This non-parametric test was chosen due to the ordinal nature of the Likert-type data and its robustness against violations of normality and the presence of tied ranks. Kendall's Tau-b was used to evaluate the association between HSB and PU, and between PB and PU.

Correlation strengths were interpreted based on established usability evaluation benchmarks described by Brooke, wherein coefficients of 0.00–0.199 were classified as very weak, 0.20–0.399 as weak, 0.40–0.599 as moderate, 0.60–0.799 as strong, and 0.80–1.000 as very strong.[44]

Potential confounders—such as age, gender, occupation, educational attainment, and access to smartphones or internet—were conceptually acknowledged due to their established influence on both health-seeking behavior and technology adoption.[45] These variables, although not statistically controlled in the current analysis, were considered during interpretation of results.

Additionally, possible effect modifiers were conceptually identified. These include digital literacy, prior experience with mobile health applications, and trust in digital technology, all of which may influence or alter the strength and direction of the relationships between HSB, PB, and PU.[46] While not directly measured, their potential moderating roles were considered in interpreting the study's findings.

Ethical Considerations

Prior to the study's commencement, ethical clearance was obtained from the Institutional Review Board (IRB) of the affiliated university under Ethics Clearance Protocol Number: 2023-2nd-CNU-Vasquez-v1. Additionally, formal permission to conduct the research within the community was secured from the Barangay Captain of the selected site in Marikina City.[47]

A comprehensive informed consent process was carried out. Prospective participants were thoroughly briefed on the study's objectives, procedures, duration, potential risks and benefits, and their rights—including the right to refuse participation or withdraw at any point without consequence. This information was conveyed in clear, accessible language using a standardized script. Participants were encouraged to ask questions, and only those who provided written, voluntary consent were included in the study.[48]

To ensure the protection of privacy and confidentiality, no personally identifiable information (e.g., names, contact numbers, or addresses) was recorded in the data collection instruments. Instead, participants were assigned unique alphanumeric codes to anonymize their responses. Paper-based surveys were stored securely in a locked cabinet accessible only to principal investigators, while digital files were encoded on password-protected devices. No raw data were disclosed to individuals outside the authorized research team.[49]

RESULTS

Table 1 presents the demographic profile of middle-aged individuals diagnosed with hypertension and actively taking maintenance medication within a Marikina City community. Applying a Design Thinking approach, particularly the empathize phase, this data helped the researchers gain a deeper understanding of the users' backgrounds, lifestyles, and potential challenges in adopting mobile health (mHealth) technologies. The age distribution showed that nearly half (47.8%) of respondents were between 50–59 years old, while 37.0% were aged 40–49, and only 15.2% were 30–39 years old, suggesting that most users were in the later stages of middle age—an important consideration when designing technology for populations that may face age-related barriers in digital engagement.

Gender distribution revealed a higher proportion of female participants (55.8%), which aligns with global trends showing that women are more likely to engage in healthcare-related interventions. Civil status data indicated that 67.4% were married, potentially pointing to a supportive environment for health management—an insight valuable for co-designing features that incorporate family or caregiver participation during the ideation and prototyping phases. Regarding education, the largest group were high school graduates (44.9%), followed closely by those with only elementary education (33.3%) and college graduates (20.3%). This mixed educational background underscores the need for clear, intuitive app design and accessible language, tailored especially for users with limited exposure to complex digital tools.

Table 1. Demographic Profile of Middle-aged Individuals who had been Formally Diagnosed with Hypertension and were Actively Taking Maintenance Medication (n=138)

Demographic Parameters	Frequency	Percentage (%)
Age (years)		
30 - 39	21	15.2
40 - 49	51	37.0
50 - 59	66	47.8
Biological Sex		
Male	61	44.2
Female	77	55.8
Civil Status		
Single	32	23.2
Married	93	67.4
Separated	3	2.2
Widowed	10	7.2
Highest Educational Attainment		
No Formal Education	1	0.7
Elementary Graduate	46	33.3
High School Graduate	62	44.9
College Graduate	28	20.3
Doctorate Degree	1	0.7
Combined Gross Family Income (PhP)		
Less than 10,000	26	18.8
10,001 - 15,000	48	34.8
15,001 - 20,000	42	30.4
20,001 - 25,000	15	10.9
More than 25,001	7	5.1

Family income distribution revealed that a majority of respondents (84.0%) reported monthly incomes at or below PHP 20,000, signaling financial constraints that may influence access to smartphones, mobile data, or digital literacy programs. This insight reinforces the necessity of designing affordable, inclusive, and low-bandwidth-compatible solutions during the define and prototype phases of Design Thinking. Collectively, these demographic insights support a human-centered approach to digital health innovation by ensuring that the final product addresses the real-world needs and limitations of the target user group, ultimately promoting greater usability, adoption, and sustained engagement.

Table 2 presents the overall mean scores and corresponding verbal interpretations for Health-seeking Behavior

Table 2. Overall Mean and Interpretation of Health-seeking Behavior, Perceived Barriers of Medication Tracker Usage, and Perceived Usability of Medication Tracker of Middle-aged Individuals (n=138)

Indicator	Overall Mean Score	Verbal Interpretation
Health-seeking Behavior	3.23	High
Perceived Barriers	2.06	Moderate
Perceived Usability	2.80	Moderate

1.00 to 2.00 (low health-seeking behavior); 2.01 to 3.00 (moderate behavior); 3.01 to 4.00 (high behavior). (Adapted from Phoong et al.)[43]

Table 3. Correlation of Health-seeking Behavior and Perceived Barriers to Perceived Usability of Medication Tracker

Dimension	Perceived Usability		Interpretation
Health-seeking Behavior	Kendall's Tau B	**0.123**	**Weak Positive Relationship**
	p-value	**0.049**	
Perceived Barriers	Kendall's Tau B	-0.402	**Moderate Negative Relationship**
	p-value	<0.001	

p <0.05 indicates statistical significance; results are unlikely due to chance.

(HSB), Perceived Barriers (PB), and Perceived Usability (PU) of the medication tracker application among middle-aged individuals. The HSB yielded a high mean score of 3.23, verbally interpreted as "High," indicating a proactive disposition toward health management within the population. This insight, rooted in the empathize phase of the Design Thinking approach, reflects users' intrinsic motivation to manage their health—an essential consideration in designing user-centered mHealth tools.

The PB dimension recorded a moderate mean score of 2.06, interpreted as "Moderate," suggesting that while users face certain challenges—such as unfamiliarity with technology or concerns about privacy—these barriers are not overwhelmingly restrictive. This finding aligns with the define phase of Design Thinking, where user pain points and contextual constraints are identified to inform iterative design improvements.

The PU dimension also received a moderate overall mean of 2.80, with a verbal interpretation of "Moderate." Although this reflects a generally acceptable level of usability, lower scores in areas such as ease of use signal opportunities for refinement in user interface and system design. These outcomes reinforce the need for further exploration in the test phase, where user feedback can guide iterative prototyping and enhance alignment between the application's functionality and users' real-world needs and expectations.

Table 3 presents the correlation between Health-seeking Behavior (HSB) and Perceived Barriers (PB) with Perceived Usability (PU) of the medication tracker among middle-aged individuals. Statistical analysis revealed a significant relationship between HSB and PU, with a p-value of 0.049. Although the Kendall's Tau B coefficient of 0.123 indicates a weak positive correlation, this suggests that individuals who are more proactive in seeking health information tend to perceive the application as slightly more usable. This finding aligns with the empathize phase of the Design Thinking approach, which underscores the importance of understanding user behavior and motivation in informing user-centered solutions.

Moreover, a highly significant correlation was observed between PB and PU, with a p-value of <0.001 and a Kendall's Tau B coefficient of -0.402, indicating a moderate negative relationship. This result illustrates that individuals who experience more barriers—such as technological unfamiliarity, difficulty navigating the app, or privacy concerns—are more likely to perceive the application as less usable. This insight reflects the define phase, where user pain points are clearly articulated and prioritized, and it supports the test phase, where iterative feedback loops are crucial to refining the design and improving usability.

These findings emphasize the critical role of understanding end-user experiences in developing effective mHealth technologies. By embedding Design Thinking principles into the research process, particularly through user engagement and iterative feedback, more responsive and accessible health applications can be created to meet the real-world needs of diverse user populations.

DISCUSSION

The present study uncovered significant patterns in health-seeking behavior (HSB), perceived barriers (PB), and perceived usability (PU) of a mobile medication tracking application among middle-aged adults diagnosed with hypertension in Marikina City, Philippines. Grounded in the Design Thinking framework, this research adopted a user-centered lens to assess the contextual relevance and functional effectiveness of mobile health (mHealth) tools in an urban community setting.

Aligned with the study's first objective, a weak positive correlation was found between HSB and PU (Kendall's Tau-b = 0.123, p = 0.049), suggesting that individuals who actively engage in health-related behaviors may demonstrate a slight inclination toward using digital tools. However, the strength of this relationship was modest, reinforcing a critical insight from the Ideate phase of Design Thinking: behavioral intention does not necessarily translate into actual usage. This observation is consistent with theoretical models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), both of which distinguish between intention and actual behavior.[50] Thus, even individuals with high health awareness may fail to adopt mHealth applications unless those tools are intuitive, accessible, and responsive to their specific needs.

In contrast, the second objective yielded a more pronounced relationship. A moderate negative correlation was identified between PB and PU (Kendall's Tau-b = -0.402, p <0.001), indicating that as users perceive more barriers, their assessment of the application's usability declines. Reported barriers included limited digital literacy, interface complexity, and unfamiliarity with mobile platforms—challenges that emerged during the Define and Test phases of the Design Thinking process.[51] These findings are consistent with earlier work that emphasized cognitive and structural barriers to the adoption of digital health technologies.[52-56] Addressing these obstacles through empathic design and iterative refinement is therefore critical for enhancing user experience and long-term engagement.

Participants generally acknowledged the potential of the Simpill app but reported difficulties in navigation and user interface design. These findings suggest that the primary challenge is cognitive rather than technological—a concern well-documented in previous studies involving older adult users.[57] The Design Thinking approach, particularly its Prototype and Test phases, supports the need for simplified and inclusive designs co-developed with users. Iterative testing and feedback loops may reduce cognitive burden and improve overall adoption among target users.

Socio-demographic analysis further revealed meaningful user characteristics. A majority of the respondents were female, aged 50–59, married, and had attained a secondary level of education. This profile is consistent with both the gendered epidemiology of hypertension and caregiving roles often assumed by women in low- and middle-income countries.[58-60] These attributes, contextualized within the Define phase, point to the influence of social determinants—such as family responsibilities and educational background—on digital engagement and health behavior patterns.

Although the generalizability of the study is limited to similar urban and digitally enabled populations, the implications for public health planning in Marikina City are particularly compelling. The city has demonstrated a strong commitment to integrating digital platforms in governance and health services, notably through Marikina City Ordinance No. 065, Series of 2018, which promotes mobile technology for public service delivery.[61] This policy environment, combined with high digital literacy rates and robust infrastructure, positions Marikina as an ideal setting for implementing scalable mHealth solutions.

Moreover, the urgency for such interventions is underscored by the city's cardiovascular mortality rate. In 2019, Marikina recorded 1,376 cardiovascular-related deaths, the highest mortality rate in Metro Manila at 288.3 per 100,000 population.[62] As hypertension is a primary modifiable risk factor for cardiovascular disease, targeted strategies for disease monitoring and medication adherence are essential.[63] Well-designed mHealth applications like Simpill, if adapted through user-centered approaches, may offer a scalable solution for addressing this burden.

According to the Philippine Development Plan 2023–2028, which outlines the nation's eHealth Strategic Framework promoting mobile-enabled health interventions in urban areas, this study highlights the importance of investing in support systems such as digital literacy initiatives, interactive app tutorials, and responsive helpline services.[64] These measures can enhance adoption and sustained use, particularly among middle-aged adults managing chronic health conditions.

Critically, while high health-seeking behavior can catalyze initial interest in mHealth tools, this study finds that the mitigation of perceived barriers has a more substantial impact on perceived usability and sustained engagement. The incorporation of Design Thinking throughout the research process validated the importance of empathy, user feedback, and iterative refinement. By embedding lived experiences into the app design and evaluation, the study strengthens the case for participatory and human-centered innovation in digital health.

Limitations

This study acknowledges several methodological and contextual limitations that may have influenced the validity and generalizability of its findings. While offering valuable insights into the perceived usability of a mobile medication tracking application, the results should be interpreted with caution.

First, the use of a cross-sectional, descriptive-correlational design limits causal inference. Since data were collected at a single point in time and without a control group, the study cannot determine whether use of the Simpill application led to improvements in health-seeking behavior (HSB) or reductions in perceived barriers (PB). The findings are limited to associations and do not reflect longitudinal or behavioral changes over time.

Second, the reliance on self-reported data introduces risks of recall and social desirability bias. Participants may have overestimated their engagement with health services or underreported barriers to using the app. Such biases could inflate HSB scores or minimize PB ratings, potentially affecting the strength and direction of observed relationships.

Third, the structured questionnaire format, though pilot-tested and translated into Filipino, restricted the depth of responses. Important usability insights—such as emotional responses, interface difficulties, or cultural attitudes toward mobile health (mHealth)—may have been overlooked. Additionally, varying levels of health and digital literacy may have contributed to comprehension bias, with some respondents possibly misinterpreting key terms despite language adjustments.

External validity was also limited by purposive sampling. The study focused exclusively on middle-aged adults (30–59 years old) with hypertension, residing in Barangay Industrial Valley, Marikina City, and using Android smartphones. This narrow scope excluded iOS users, other age groups, and individuals without digital access, thereby restricting the generalizability of the findings to other communities or populations. The sample also showed overrepresentation of females and individuals with secondary education, which may have influenced usability perceptions and digital engagement patterns.

Furthermore, relevant clinical data—such as medication frequency, duration since diagnosis, or comorbid conditions—were not collected. These variables likely affect motivation, digital engagement, and perceptions of usability, and their absence limits the ability to assess the app's suitability across various stages of chronic disease management.

Although the sample size (n = 138) met the threshold for correlation analysis, it was insufficient for subgroup comparisons or multivariate analyses. Uncontrolled confounding variables such as income, prior mHealth experience, or social support may have influenced outcomes, limiting internal validity.

Lastly, the evaluation of perceived usability was based solely on subjective feedback after a two-week exposure, with no objective usage metrics (e.g., log-in data, adherence tracking). The Simpill application, being an adapted rather than researcher-developed tool, may also have had design limitations beyond the research team's control.

Future studies should consider randomized designs, mixed-methods approaches, and broader sampling to enhance the depth, accuracy, and applicability of findings in mHealth research.

CONCLUSION

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This study, grounded in the Design Thinking framework, explored the interplay among health-seeking behavior, perceived barriers, and perceived usability of the Simpill medication tracking application among middle-aged hypertensive adults in Marikina City. Findings revealed that while participants generally demonstrated high levels of motivation to manage their hypertension and adopt digital health solutions, usability challenges—particularly related to digital unfamiliarity and navigation—moderately hindered their experience with the app. The correlation analysis confirmed that perceived barriers had a greater negative impact on usability than motivation alone, emphasizing the need for user-centered technological solutions that prioritize simplicity, clarity, and confidence-building.

The results hold important implications for Marikina City, a locale with a high burden of cardiovascular disease and a strong foundation in digital infrastructure and governance. Despite the city's high digital inclusion readiness—supported by local ordinances, public-private ICT investments, and strong health governance—the presence of usability issues in a relatively tech-enabled population underscores the persistent gap between digital access and actual digital engagement. This suggests that even in digitally advanced settings, the success of mobile health (mHealth) initiatives depends on context-sensitive design that aligns with users' real-life capabilities, needs, and preferences.

Given Marikina's readiness for digital transformation and its commitment to health innovation, the findings can guide local policymakers and health program implementers in refining their mHealth strategies. Targeted interventions such as digital literacy campaigns, community-based app orientation, and the co-creation of simplified app interfaces can help bridge usability gaps. Moreover, continuous user feedback and iterative testing can enhance acceptance and sustained use of digital health tools among middle-aged adults.

While the study's findings may not be broadly generalizable, they offer actionable insights specific to Marikina City. They reinforce the importance of applying user-centered design principles in developing and deploying health technologies, particularly in urban communities with an existing foundation for digital health innovation. By addressing the identified barriers, the city can better leverage mobile applications to support hypertension management, improve health outcomes, and serve as a model for other local government units pursuing similar digital health initiatives.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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