Mobile android application development for anxiety and pain management: usability and validity testing of audio hypno-spiritual therapy in ICU settings

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Abstract. Anxiety and pain in patients with acute coronary syndrome (ACS) can worsen their condition and extend hospital stays. Conventional therapies, including hypnosis and spiritual support, are beneficial but often limited by time and staffing. This study aims to develop and validate a mobile-based Audio Hypno-Spiritual Therapy application, "Harmony," to address these limitations. This research and development study used a prototype model. Validity was assessed by four experts in hypnosis, spirituality, critical care nursing, and cardiovascular disease, chosen for their expertise in relevant fields, using Aiken's V analysis. Usability testing with eight ICCU patients evaluated the application's practicality and effectiveness. The Harmony app demonstrated strong validity with an Aiken's V value of 0.86. Usability testing, conducted with the USE Questionnaire, produced satisfaction scores ranging from 5.06 to 5.75 out of 7, indicating positive user experience and high satisfaction. The Harmony application shows high validity and usability, supporting its potential as a practical approach to reduce anxiety and pain in ACS patients in the ICCU. Future studies should include larger samples and evaluate the long-term impact of this intervention on patient outcomes. Keywords: Acute Coronary Syndrome; Anxiety Relief; Audio Therapy; Pain Management; Mobile Android Application.

1 Introduction

Coronary heart disease (CHD) remains the leading cause of death worldwide, with approximately 17.3 million fatalities each year attributed to cardiovascular diseases. According to the World Health Organization (WHO), this number is projected to rise to 25 million by 2030, signaling a global health crisis [1]. In Asia, acute coronary syndrome (ACS), a critical manifestation of CHD, is expected to become the primary cause of mortality, with mortality rates in Indonesia steadily increasing since 1992 [2].

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Patients with CHD often experience severe anxiety and stress due to uncertainties surrounding their diagnosis, doubts about recovery, fear of death, and feelings of [3]. For ACS patients admitted to intensive care units (ICUs), factors such as complex medical procedures, a noisy environment, and separation from loved ones exacerbate their anxiety levels [4, 5]. This anxiety peaks within the initial 48 to 72 hours of care and, if left unmanaged, can trigger the release of stress hormones like cortisol, epinephrine, and norepinephrine, leading to an increase in heart rate, respiratory rate, blood pressure, and oxygen demand—all of which are particularly dangerous for ACS patients as they can precipitate sudden death. Indeed, the mortality risk for ACS patients experiencing anxiety is nearly five times higher than for those without anxiety [6].

Anxiety also exacerbates pain levels in ACS patients due to its impact on pain thresholds and heightened sensitivity to pain. Pain, caused by ischemic injury to the heart muscle, can worsen if anxiety is not managed effectively, potentially leading to vasoconstriction, increased heart rate, and cardiac workload [7]. Current pain and anxiety management approaches in ICUs focus mainly on physical care, often neglecting the psychological and spiritual dimensions, resulting in suboptimal relief for many patients [8].

Given the multidimensional nature of anxiety and pain, a holistic approach that includes psychological and spiritual care is essential. Pain and anxiety are influenced not only by sensory input but also by motivational and psychological factors, underlining the potential benefits of Complementary and Alternative Medicine (CAM) interventions [9]. CAM approaches, such as hypnosis and spiritual therapy, offer promising avenues to address these psychological and spiritual needs, yet their implementation in ICUs faces challenges due to limited staffing and high workloads [9].

Preliminary studies at the research site reveal that spiritual support is only available upon family request, typically provided by a single clergy member per hospital. As a result, most patients do not receive consistent spiritual support, and CAM therapies remain largely unavailable due to the absence of trained therapists in the ICCU. This highlights an urgent need for an innovative, efficient, and accessible approach to provide CAM-based anxiety and pain management for ACS patients.

Hypnosis has shown potential as a CAM modality that can enhance relaxation and reduce pain. For instance, [10] demonstrated that hypnosis therapy improves pain management in cancer patients. Additionally, Quranic and prayer-based therapies have proven effective in promoting calm and tranquility [11,12]. These therapies can be easily adapted into an audio format, allowing for simple, self-administered interventions by nurses or family members with minimal guidance, a method shown to be safe and effective for ICU patients [13]. In Islamic contexts, prayers, Quranic recitations, and zikr have been effective in reducing anxiety and pain, actively engaging patients in their therapeutic process.

The novelty of this study lies in combining hypnosis with spiritual support (prayer and zikr) into a mobile Android-based audio application called "Harmony." This app includes tools for measuring pain (Visual Analog Scale: VAS) and anxiety (General Anxiety-Visual Analog Scale: GA-VAS), enabling real-time monitoring of symptom progression and allowing for a thorough evaluation of the intervention's effectiveness in ACS patients in the ICCU.

This research aims to fill the existing gap in CAM implementation in ICU settings by developing a self-administered, audio-based therapy model accessible to both patients and their families. No previous studies have explored the combined use of hypnosis and spiritual therapy through a smartphone application to alleviate anxiety and pain in ACS patients in ICCUs. By addressing these gaps, this study seeks to contribute valuable insights into holistic patient care and propose a feasible, supportive model for anxiety and pain management in critical care settings.

2 Research Methods

Harmony, an Audio Hypno-Spiritual Therapy application, was developed using a Research and Development (R&D) approach with a prototype model. This method was selected to ensure the application's alignment with clinical needs through iterative testing and feedback from experts and users. This approach enables the application to meet technical functionality standards and usability requirements, adapting effectively to the specific demands of an ICU environment.

Two groups of participants were involved in this study: expert testers and usability testers. The expert testers consisted of five individuals from diverse backgrounds: an Islamic religious leader (ustadz), a hypnosis practitioner, a nursing expert in cardiovascular diseases, a hypnosis researcher, and an information technology expert. They validated the application's content, features, and performance. Inclusion criteria for the experts were a willingness to participate, over five years of experience in their field, and being of the Islamic faith.

For usability testing, eight patients with acute myocardial infarction, currently in the ICU at Dr. Margono Soekarjo Hospital in Purwokerto, were selected. Inclusion criteria included being in stable condition, able to communicate, and able to use a mobile android.

2.1 Needs Analysis

The initial stage involved identifying the specific requirements and preferences of potential users. This was accomplished through literature reviews, interviews with experts, and surveys of target users. The goal was to gather comprehensive information on the desired features and functionalities of the application.

2.2 Prototype Design

Based on the insights gathered during the needs analysis, a preliminary design of the application was created. This included designing the user interface, determining the core features, and planning the overall structure of the application. The design aimed to ensure user-friendliness and effectiveness in delivering audio hypno-spiritual therapy.

2.3 Implementation

The next step was developing the prototype based on the design specifications. This involved coding and creating the initial version of the application. The prototype included essential features and functionalities, enabling initial testing and feedback collection.

2.4 Evaluation and Revision

The prototype underwent rigorous testing, assessed by four experts in hypnosis, spirituality, critical care nursing, and cardiovascular health, based on criteria of content relevance, audio quality, ease of use, and cultural appropriateness [14]. For usability testing, eight ICU patients were selected; this sample size was determined to balance logistical feasibility with adequate data for preliminary insights into user interaction and experience.

Feedback from expert reviewers emphasized content relevance, functionality, and performance, while usability testers offered insights into user experience and practicality in clinical settings. This input informed a prioritized set of revisions, focusing on enhancing effectiveness and usability through iterative refinement.

Usability testing was conducted in the Intensive Cardiac Care Unit (ICCU) at Dr. Margono Soekarjo Hospital, where patients were instructed on app usage before independently interacting with it. Usability was measured using the USE questionnaire, which evaluates product usability across three main dimensions—Usefulness, Satisfaction, and Ease of Use—on a 1-7 scale [15].

Fig. 1. The stages of Harmony application development are shown in.

3 Data Analysis

Data analysis was conducted using IBM SPSS Statistics 26. The validity of assessment tools was evaluated through Aiken's V analysis, drawing on ratings from four experts across relevant fields to measure content validity. Higher Aiken's V values indicate greater agreement on item relevance, with values nearing 1.00 signifying optimal expert consensus [16].

Usability testing was assessed using the USE Questionnaire, which measures Usefulness, Satisfaction, and Ease of Use. Descriptive statistics, including means and standard deviations for each component, were calculated to evaluate overall user experience. Results were organized in tables and graphs, offering a clear presentation of validity and usability data to support reliable conclusions on the intervention's effectiveness.

4 Ethical Clereance

The study was conducted in accordance with ethical standards and has received approval from the Health Research Ethics Committee of Prof. Dr. Margono Soekarjo Hospital. Ethical clearance was granted under approval number 420/18109, ensuring that all procedures adhered to the required ethical guidelines for research involving human subjects.

5 Result

5.1 Overview of Harmony Application Development

The developed product is a mobile application named Harmony, which stands for Hypnosis Assisted Islamic Resilience for Mindful Self-Healing. This application is specifically designed for the Android platform and demonstrates a clear integration of hypnosis principles with Islamic teachings, aimed at alleviating anxiety and pain in patients with acute coronary syndrome (ACS) while promoting a harmonious balance between mind and body through structured nursing interventions. Harmony is optimized for Android version 7 (Nougat) with API level 24 and has been tested successfully on newer Android versions, including Android 13 (Tiramisu), Android 14 (Upside Down Cake), and Android 15 (Vanilla Ice Cream), ensuring broader accessibility for users.

Harmony offers a range of key features designed to support patient care, including audio therapy sessions that utilize hypnosis and Islamic teachings, and tools for assessing anxiety and pain through the Visual Analog Scale (VAS). Additionally, the application includes monitoring tools for vital parameters such as blood pressure, Mean Arterial Pressure (MAP), respiratory rate, and pulse rate. Empirical evidence supports the efficacy of audio therapy in

managing anxiety and pain, indicating that these features can enhance patient outcomes through a comprehensive approach to care [17,18].

The application utilizes key technologies, including Kotlin and the Android Software Development Kit (SDK), chosen for their efficiency in mobile development. Kotlin's concise syntax and interoperability with Java facilitate quicker development, while the Android SDK offers extensive tools for seamless integration of native features and user interfaces. Data storage is handled locally using SQLite for reliability and quick access, complemented by Firebase as a cloud-based backend for enhanced scalability and data management. The user interface is designed with native Android components organized into Activities and Fragments, ensuring an intuitive experience. For data visualization, the app employs MPAndroidChart, allowing clear representation of user data. Firebase integration supports user login and registration, with Firebase Authentication ensuring data security by protecting user information. This combination of technologies enhances overall user experience and security [19,20].

In the prototype model, needs analysis is vital for understanding user requirements and expectations. A thorough analysis helps developers align the prototype with user preferences [21–23]. The need analysis for the development of the Harmony application was conducted through a comprehensive review of the literature and discussions with experts from various fields, including hypnotherapy, intensive care, and ICU nursing. The analysis revealed the necessity for a model to manage anxiety and pain in patients with acute coronary syndrome. The proposed model should be holistic, user-friendly, and secure, addressing both the psychological and physical needs of the patients in an integrated manner.

The needs analysis for the application design highlights the critical requirements of ACS patients, as identified through expert input and supported by literature. Experts emphasized the importance of features such as user-friendly vital signs monitoring and audio-based relaxation sessions, aligning with findings from previous studies that demonstrate the significant impact of technology-based interventions in reducing anxiety [24]. One expert noted, *"Patients often struggle to access technology-based therapies that meet their emotional needs."* This insight guided the integration of spiritual elements into the application's design, ensuring it addresses both the physiological and emotional challenges faced by ACS patients. Such an approach underscores the application's potential to provide holistic support, validated by both expert perspectives and empirical evidence.

The design of the Harmony application is predicated on the primary objective of managing anxiety and pain in patients diagnosed with acute coronary syndrome. The application is developed to facilitate nurses in providing holistic care to patients, with a user-centered design approach that emphasizes user comfort and accessibility.

This design methodology follows a user-centered design (UCD) framework, ensuring that the application aligns with the specific needs and preferences of its users. By incorporating insights from experts in hypnotherapy, intensive care, and ICU nursing, the design process accurately addresses the challenges faced by patients with acute coronary syndrome (ACS). Expert input informed key features, such as user-friendly vital signs monitoring and relaxation techniques, aimed at alleviating anxiety and pain. This collaborative approach ensures that the application is both clinically relevant and practical, effectively meeting the physiological and psychological needs of ACS patients.

The application integrates several core features, including Harmony therapy, therapy scheduling, clinical indicators, and health trend graphs (Figure 2). These features are meticulously designed to deliver holistic therapy in accordance with user-adjustable schedules. Clinical indicators consist of records of pain scores, anxiety scores, blood pressure, pulse rate, and respiratory rate, both before and after the therapy sessions. The health trend graphs are instrumental in visualizing the longitudinal trends of these clinical indicators over time.

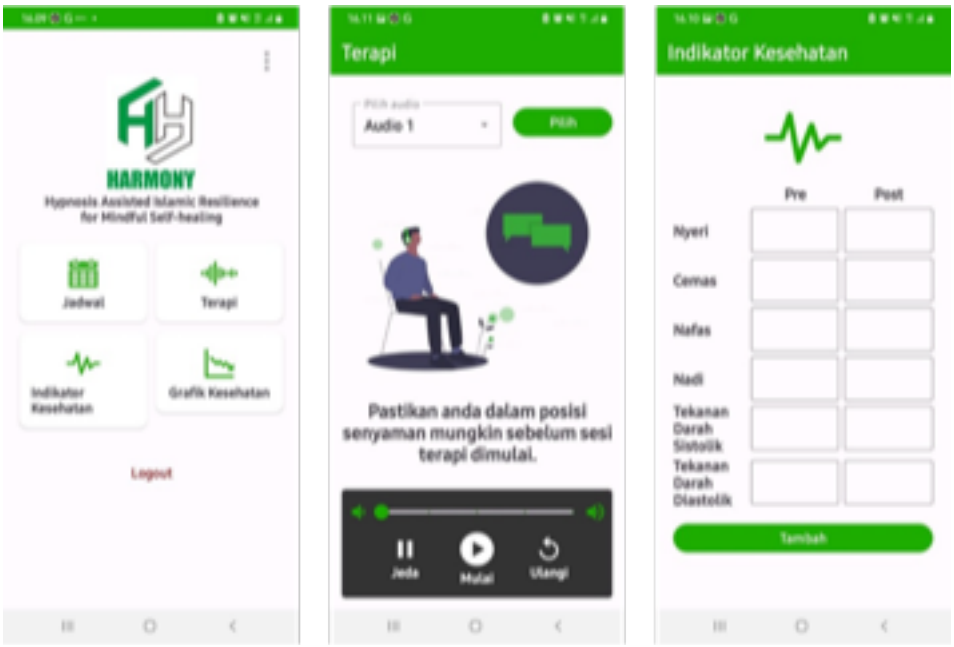

Fig. 2. The interface overview of the Harmony application can be seen

Fig. 3. Main Features on Harmony Application

Based on initial user testing, users had difficulty locating the vital signs monitoring menu, leading to adjustments in the user flow to improve access to this feature. The application's user flow is designed for seamless and intuitive navigation, from login to the core features. To address user feedback, the pathway to vital signs monitoring was simplified, and the navigation structure was streamlined to meet user preferences for simplicity. These changes enhance the application's usability, ensuring a more efficient and user-friendly experience by aligning with user needs and expectations. Figure 4 illustrates the schematic user flow from the initial login to the final stages of application use.

Fig. 4. User Flow

The Harmony application prioritizes effective data management, user interface design, and security. User data is securely handled through a dual approach: local storage with SQLite, which allows for quick access and reliability, and cloud-based management via Firebase, enabling efficient data handling and scalability. For instance, SQLite facilitates rapid retrieval of user data, while Firebase allows for real-time updates and remote access, enhancing user experience access [25]. The user interface is crafted using native Android UI components, incorporating Activities and Fragments, which ensures a consistent and user-friendly experience across various devices [26]. To enhance data visualization, MPAndroidChart is utilized, providing clear and informative graphical representations. Additionally, Firebase integration streamlines functionalities such as user login and registration, with robust security measures in place to protect sensitive user information [27]. This strategic combination of technologies significantly improves data management efficiency and security within the application.

The technology used for the user interface ensures clear and consistent presentation of information across various device formats. The application is optimized for different screen sizes, including smartphones and tablets, operating on the Android system, ensuring a seamless user experience across all platforms [28]. This adaptability to multiple devices enhances the app's usability, making it accessible to a broader range of users.

To ensure robust data security, the application employs advanced encryption techniques and strict privacy policies. Additionally, Firebase Authentication is integrated to verify user identities, ensuring that only authorized users can access the app's critical features. Figure 2 provides an illustration of the Harmony app interface.

5.2 Harmony Application Testing

There are two types of testing conducted on the Harmony application prototype: validity testing and usability testing. Validity testing, covering both content and construct validity, was carried out using Aiken's V coefficient. This involved nine items, including: the appropriateness of the hypnosis style used, the accuracy of the induction technique, the suitability of the protocol and clinical ethics, safety and effectiveness, its potential to reduce pain and anxiety, engaging features, the validity of pain and anxiety measurement tools, and ease of use.

The validity test of this prototype was conducted by four experts, including a hypnosis practitioner, a researcher in the field of hypnosis, an intensive care specialist, and an islamic religious expert. The data of these four experts can be seen in Table 1.

Table 1. Expertise Data in the Validity Test.

No	Initials	Age (Years)	Gender	Education Level	Area of Expertise
1	ARF	44	Male	PhD	Hypnotherapy reseacher, Medical-Surgical Nursing
2	SA	44	Male	PhD	Critical Care Nursing, Hypnotherapy
3	NP	39	Male	Master's Degree	Hypnotherapy practicioner, Community Health Nursing
4	AA	37	Male	Master's Degree	Islamic Religious Expert, Medical-Surgical Nursing

Table 1 demonstrates that all experts have a background in nursing, with 75% (n=4) possessing specialized expertise in hypnotherapy. This indicates that the experts involved have a high level of competency in validating the Harmony application, ensuring that the validation process is conducted with a high degree of professional and technical accuracy.

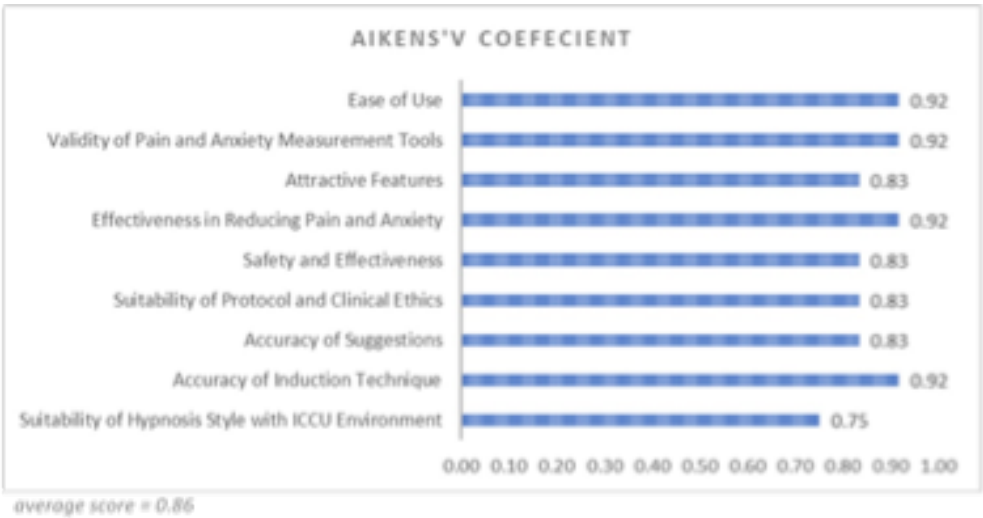

Fig. 5. The results of the validity test are presented

Figure 5 shows that the Aiken's V coefficient scores range from 0.75 to 0.92, with an average score of 0.86.

Several experts contributed valuable insights through the validity test questionnaire. One expert, referred to as ARF, emphasized the necessity for an additional pain measurement tool tailored for unconscious patients: "*The application can be generally used to reduce pain and anxiety, especially for Muslim patients. It is suitable for self-use by fully conscious patients. If the patient is unconscious, the application should be operated by a nurse or family member using pain assessment tools for unconscious patients, such as the CPOT or others*" (ARF, validity test questionnaire, November 2023). Another expert, NP, recommended that the application should be made available for free on the Play Store: "*The final product should be*

accessible for free to those in need, particularly on the Play Store" (NP, validity test questionnaire, November 2023). This feedback underscores the importance of ensuring that the application is widely accessible at no cost, thereby reaching a broader audience and effectively fulfilling its intended purpose. Incorporating such expert input not only strengthens the application's design but also aligns it with identified needs in the literature regarding accessibility and usability for diverse patient populations.

The usability test was conducted with eight patients diagnosed with acute coronary syndrome who were receiving care in the ICU. The evaluation utilized the USE Questionnaire to assess the application's usability

The data of the ICU patients who participated in this usability test are presented in Table 2. The results of the usability test, conducted to evaluate the ease and effectiveness of using the Harmony application by ICU patients, are presented in Figure 5.

Table 2. Usability Test Participant

No	Initials	Age (Years)	Gender	Length of Stay (days)
1	P1	43	Male	2
2	P2	45	Male	3
3	P3	52	Female	2
4	P4	39	Male	2
5	P5	40	Female	2
6	P6	47	Female	2
7	P7	41	Male	3
8	P8	44	Male	2

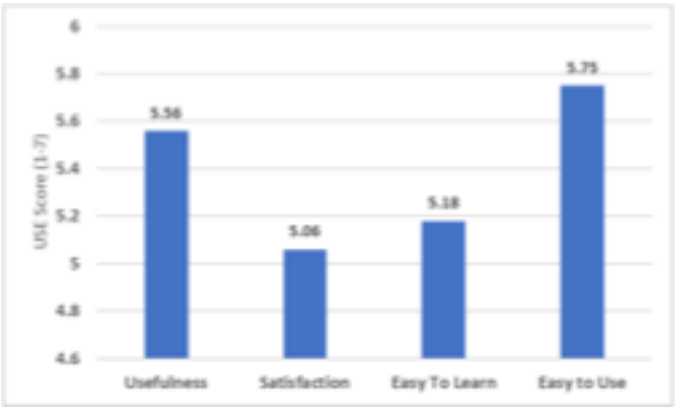

Fig. 6. The usability test range

Figure 6 shows that the component scores in the usability test range from 5.06 to 5.75 out of a maximum score of 7. This indicates that users perceive the Harmony application as

having good functionality, being easy to use and learn, and providing a satisfactory experience overall.

6 Discussion

6.1 Overview of Harmony Application Development

The Harmony application serves as a therapeutic tool that integrates hypnosis principles with Islamic teachings to achieve a harmonious balance between mind and body through systematic nursing interventions. This holistic approach is particularly crucial for critically ill patients in the ICU, where the complexities of acute coronary syndrome (ACS) necessitate coordinated, multidisciplinary care strategies. Research indicates that holistic care can significantly enhance clinical outcomes by addressing not only physical symptoms but also broader health determinants that impact recovery and long-term health health [29,30,31]. Studies indicate that a significant proportion of ACS patients (35%–73%) experience heightened levels of anxiety and pain, which can worsen their clinical conditions [32,33,34]. The Harmony application is specifically designed to alleviate these symptoms, thereby facilitating a more comprehensive recovery process.

Holistic care encompasses psychological support, lifestyle modifications, and complementary therapies alongside standard medical treatments. Interventions such as counseling, stress management techniques, and physical rehabilitation can effectively mitigate anxiety and pain, fostering improved patient outcomes [32,35].

Data management within the application leverages SQLite for local storage and Firebase for cloud-based data management, ensuring both security and efficiency. SQLite is renowned for its robust security features and is widely used in Android applications, where it handles approximately 70% of write operations [36–38]. Firebase adds an additional layer of security with features like customizable access controls through Firebase Security Rules and encryption methods such as AES and Fernet to protect user data during storage and transmission. This comprehensive security framework is vital, as data breaches could have severe implications for user privacy and trust [39, 40].

The user interface is built using native Android components based on Activities and Fragments, ensuring a consistent and accessible experience. Chart libraries like MPAndroidChart facilitate clear data visualization, while XML layouts improve information presentation, making the interface more user-friendly [41,42]. Harmony is optimized for various screen sizes, accommodating both smartphones and tablets, thereby enhancing usability [43,44].

6.2 Harmony Application Testing

The validation testing of the Harmony application prototype involves both content validity and construct validity assessments to ensure comprehensive coverage of essential elements and accurate measurement of the underlying theoretical construct. Aiken's V coefficient is employed to evaluate both validity types, demonstrating strong relevance and thoroughness of the application’s content [45]. Aiken's V is a flexible statistical measure that adapts to various contexts, making it a reliable tool for diverse research applications [46–48]. Scores for the Harmony application range from 0.75 to 0.92, with an average of 0.86, indicating very high validity and expert agreement on the application's effectiveness in reducing anxiety and pain [49].

To assess usability, the USE (Usefulness, Satisfaction, and Ease of Use) Questionnaire is utilized, focusing on key user experience metrics [50]. The scores, ranging from 5.06 to 5.75

out of a maximum of 7, reflect positive user perceptions of functionality and satisfaction, underscoring the application's potential for effective use in real-world settings. High usability scores are particularly crucial in clinical environments, where ease of use directly influences patient engagement and adherence to therapeutic interventions [51,52].

7 Limitations of The Study

Despite the strengths of the Harmony application, several limitations persist. The small sample size in usability testing may restrict the generalizability of findings to the broader user population. Moreover, the focus on ACS patients in the ICU may not adequately represent the needs of a wider audience. The study did not assess long-term engagement or effectiveness, and the reliance on self-reported data from the USE Questionnaire introduces potential biases. Future research should address these limitations through larger, more diverse samples and the inclusion of long-term assessments alongside objective measures to validate findings more robustly.

8 Conclusion

The Harmony application represents a significant advancement in the therapeutic management of acute coronary syndrome (ACS) patients. By integrating hypnosis principles with Islamic teachings, it effectively addresses the common challenges of anxiety and pain in critically ill patients. This holistic approach enhances not only physical symptom management but also the psychological and social aspects of patient care, promoting overall recovery. Validation testing confirms the application's strong content and construct validity, as evidenced by high Aiken's V scores. Furthermore, usability assessments using the USE Questionnaire indicate that Harmony is user-friendly and functional, key factors that enhance patient engagement and adherence. Despite these positive findings, the study acknowledges limitations, including a small sample size and a focus on ICU patients, which may limit the applicability of the results. Future research should aim to include larger, more diverse populations and evaluate long-term effectiveness to strengthen the application's impact. In summary, Harmony holds great promise as a user-centered tool for improving anxiety and pain management in ACS patients, offering a valuable resource within patient-centered healthcare practices.

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