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DESIGNING SELF-MANAGEMENT FEATURES FOR DIGITAL ISLAMIC SPIRITUAL HEALTH INTERVENTIONS FOR ADOLESCENTS WITH SEXUAL BEHAVIOR PROBLEMS

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Abstract

Digital health interventions (DHIs) have the potential to provide culturally relevant, private support for adolescent sexual behavior problems (SBPs), yet few are designed for Muslim-majority contexts. In Malaysia, the absence of an Islamic-values-based self-management intervention (SmI) model limits the integration of faith-based principles in adolescent health interventions. This study applies the TUDER framework (Targeting and Understanding) to map existing DHIs and identify key features for an Islamic-values-based SmI design. A web search conducted from January to April 2024 identified 53 platforms across Malaysia and neighboring countries, categorized by service type and features. Semi-structured interviews with nine experts in adolescent health and Islamic spiritual interventions were analyzed thematically using Braun and Clarke's six-step process. Seven key design features—privacy, relaxation, lighthearted tone, catchiness, humor, confidence-boosting, and infographics—emerged as critical for engaging adolescents in conservative contexts. These features align with Islamic psychospiritual principles like tazkiyah al-nafs (spiritual purification). This study proposes a conceptual SmI framework that integrates these features with persuasive system design, offering a novel approach for developing culturally grounded DHIs. The framework strengthens the theoretical foundation for Islamic-values-based interventions and can be adapted to similar settings in Muslim-majority countries.

Keywords: *Islamic Psychospiritual; Persuasive Technology; Sexual Behavior; Self-Management.*

A. Introduction

Adolescence is a critical developmental stage characterized by rapid biological, cognitive, and socio-emotional changes, as individuals explore identity, relationships, and social norms (Ismail et al., 2018; Marzuki et al., 2023; Patton et al., 2016). In Malaysia and other Muslim-majority societies, sexual behavior problems (SBPs), including early sexual activity, pornography use, and sexual misconduct, present significant public health, moral, and social challenges (Bahori & Ismail, 2018; Mohd Sani, 2019; Noh et al., 2019; Siong & Tharshini, 2020). The consequences of SBPs can be severe, leading to unintended pregnancies, sexually transmitted infections, psychological distress, academic underachievement, and family disruption (Hindin & Fatusi, 2009; Mustapha et al., 2021). Within Islamic contexts, these behaviors are seen as violations of religious teachings, which highlights the need for prevention strategies that integrate behavioral self-regulation with spiritual guidance (Tan et al., 2021).

Digital health interventions (DHIs) are increasingly used to influence behavior and offer scalable, adolescent-friendly support for sensitive issues (Mohd Zukhi et al., 2023; Wies et al., 2021). Self-management intervention (SmI) provide private, accessible guidance without the need for continuous professional involvement, addressing common barriers like fear of exposure or judgment (Asbjørnsen et al., 2020; Nen & Ibrahim, 2018; Siti Fadzilah et al., 2024; Van Der Vaart et al., 2016). Globally, DHIs grounded in behavioral science and persuasive design have proven effective in promoting positive behaviors (Jamaludin et al., 2021; Wan Nooraishya & Nazlena, 2018).

In Malaysia and the broader region, however, most DHIs focus on general mental health, lifestyle, or stress management, with little to no adaptation for SBPs. When sexuality-related content does exist, it often draws from Western contexts, failing to resonate with conservative Muslim settings (Hall, 2019; Poulsen et al., 2024). While regional innovations, such as chatbots and journaling for mental health in Indonesia, show promise, a significant gap remains in Islamic-values-based DHIs specifically for adolescent SBP prevention. For example, Malaysia's MyCare COVID-19

platform, which incorporates Islamic spiritual elements, is limited to pandemic-related support, highlighting a clear need for faith-informed, preventive digital interventions.

Research indicates that culturally and religiously adapted interventions are more effective because they align with target populations' values and lived experiences (Kreuter & McClure, 2004; Resnicow et al., 1999). Islamic psychospiritual principles, including *tazkiyah al-nafs* (self-purification), *muḥāsabah al-nafs* (self-reflection), and *mujāhadah al-nafs* (self-discipline), have long informed therapeutic and rehabilitative programs (Hamjah, 2018; Mohd Haridi et al., 2019; Wan Yusoff & Mohd Amin, 2020). Despite this, these principles have rarely been translated into preventive DHIs for adolescents. Existing behavioral frameworks—such as TUDER (Wang et al., 2019), Persuasive Systems Design (Oinas-Kukkonen & Harjumaa, 2009), the Theory of Planned Behavior (Ajzen, 1991), and Fogg's Behavior Model (Fogg, 2009)—provide strong foundations for intervention design but do not explicitly incorporate religious or spiritual dimensions relevant to conservative contexts.

This research addresses three critical gaps in the existing literature: First, there is no published Islamic-values-based SmI design model for adolescent SBPs that specifies culturally and religiously grounded features. Second, existing work is limited to integrating persuasive system design with Islamic psychospiritual concepts for preventive digital platforms. Third, no conceptual framework exists for adapting DHIs to faith-oriented adolescent health promotion.

To address these gaps, this study has two main objectives: The primary objective is to identify and evaluate existing DHIs for adolescent SBPs in Malaysia and the region, with a particular focus on cultural relevance and alignment with Islamic values. The secondary objective is to propose and define key features of an Islamic-values-based SmI for SBP prevention, integrating behavioral science frameworks and psychospiritual principles, and tailored to the target population.

This study applies the first two phases of the TUDER framework—Targeting and Understanding—and integrates them with established behavioral

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models including Persuasive Systems Design (PSD), the Theory of Planned Behavior (TPB), and Fogg's Behavior Model (FBM), along with Islamic psychospiritual principles. A web search across Malaysia, Singapore, Brunei, and Indonesia, combined with expert interviews, will identify culturally grounded design features for the proposed SmI. This research contributes in three ways: (i) it maps the availability and limitations of existing DHIs in Malaysia and the region; (ii) it proposes a conceptual and methodological foundation that integrates behavioral science with Islamic principles for adolescent SBP prevention; and (iii) it advances a design framework that identifies seven culturally grounded features—privacy, relaxation, lighthearted tone, catchiness, humor, confidence-boosting, and infographic-driven guidance. Ultimately, this study is important because it ensures that conservative Muslim contexts are recognized within global knowledge while also integrating Islamic values into the broader body of research on digital health.

B. Method

This study represents the early phase of a larger research program aimed at designing an Islamic-values-based SmI for adolescent SBP prevention. Guided by the TUDER framework (Wang et al., 2019), this phase focuses on Targeting and Understanding to define the problem, identify the target population, and specify intended behavioral outcomes. Two methods were employed: a web search mapping existing DHIs across Malaysia, Singapore, Brunei, and Indonesia, and semi-structured interviews with domain experts. This combination allowed for data source triangulation, strengthening the validity of the findings and ensuring the contextual relevance of the identified design features (Plano Clark, 2017). Figure 1 presents an overview of the research framework.

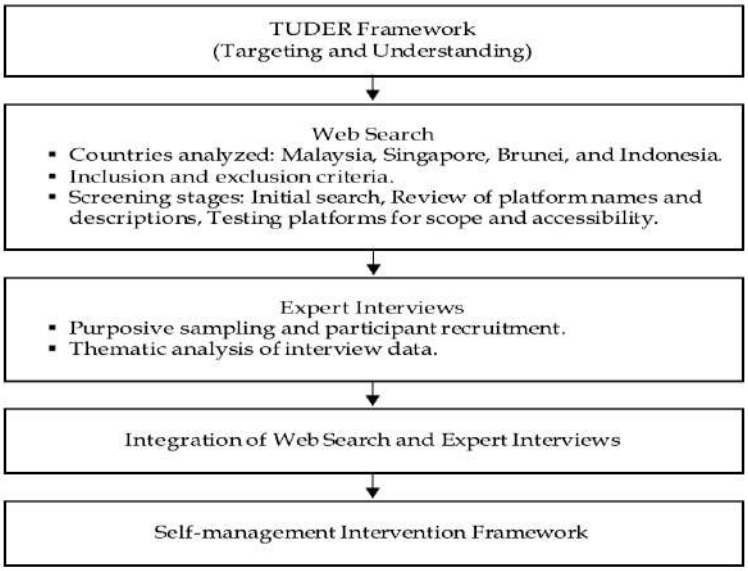

Figure 1. Research framework

Phase 1: Web search queries

Between January and April 2024, a web search was conducted to identify publicly accessible DHIs relevant to adolescent behavioral, mental, and spiritual health. Malaysia was analyzed separately, while Singapore, Brunei, and Indonesia were combined for regional comparison, given their shared sociocultural and linguistic contexts.

Searches were performed using Google and Yahoo, along with official health portals (e.g., Malaysia's Ministry of Health, Singapore HealthHub, Brunei's Health Promotion Centre, Indonesia's Ministry of Health), government directories, and NGO websites. The exact search strings, which used both UK and US English spellings, Malay terms, and Boolean operators, are provided in Appendix A to ensure transparency and replicability (e.g., "adolescent OR youth" AND "digital health OR online counselling/online counseling" AND "sexual behavior/ sexual behavior OR Islamic values OR spiritual counselling/ spiritual counseling").

The Inclusion criteria were as follows: (i) operational during the search period; (ii) provided at least one digital mode of delivery (website, app, or hybrid); (iii) offered behavioral, mental, or spiritual health services relevant to

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adolescents; and (iv) available in English, Malay, or Bahasa Indonesia. The exclusion criteria encompassed duplicates, inactive platforms, services limited to physical health only, closed-group platforms, or services without a digital component. Duplicates were identified and removed manually by comparing platform names, URLs, and ownership across sources; only the most complete entry was retained when multiple links referred to the same platform.

The screening was conducted in three stages: (i) initial search; (ii) review of platform names and descriptions; and (iii) testing platforms for scope and accessibility. In Malaysia, 70 records were identified; 44 were excluded, leaving 26 platforms. In Singapore, Brunei, and Indonesia, 110 records were identified; 83 were excluded, leaving 27 platforms. The final set comprised 53 platforms classified into seven categories: (i) counseling and therapy centers, (ii) government or university services, (iii) private specialist services, (iv) hotlines and crisis support, (v) faith-based services, (vi) multi-issue, multi-country platforms, and (vii) private specialist and thematic services. Two researchers independently coded the platforms into categories and compared their classifications. Discrepancies were discussed and reconciled through consensus, ensuring consistency without the use of a formal reliability coefficient. Figure 2 presents an adapted PRISMA-style flow diagram of the screening process.

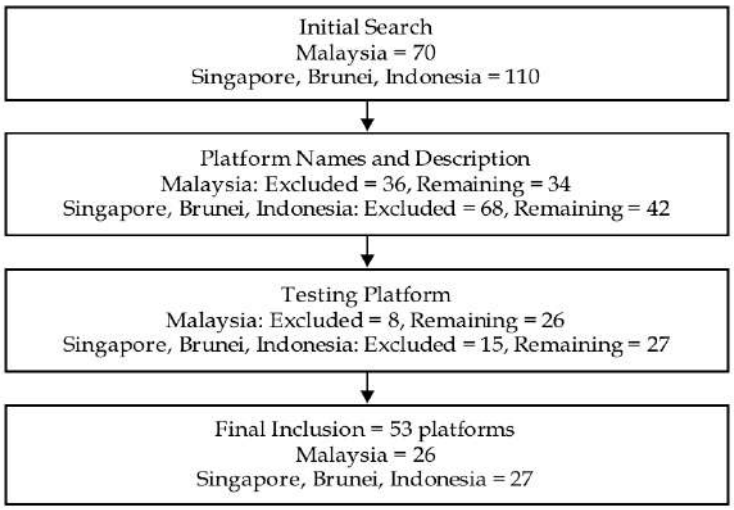

Figure 2. Screening process

Phase 2: Expert interviews

Purposive sampling was used to recruit participants with expertise in adolescent behavioral health, psychology, counseling, rehabilitation, or Islamic spiritual intervention. Eligibility required a minimum of five years' professional experience, direct involvement in adolescent-focused programs, and familiarity with digital or blended interventions. Potential experts were identified through professional networks, organizational directories, and referrals. Invitations to participants were sent via email and followed by phone calls.

A total of nine experts were interviewed: four registered counselors or psychology officers, one rehabilitation center director, and four Islamic spiritual intervention specialists, all with doctoral qualifications and more than ten years of experience. The sample size was consistent with guidance for key-informant studies, where thematic saturation is typically reached between five and twelve participants. In this study, saturation was achieved when no new SmI features emerged after the ninth interview. The final sample of nine participants therefore falls within the accepted range for qualitative health intervention research (Guest et al., 2006; Muellmann et al., 2021).

The interviews were conducted online via Google Meet between February and March 2024, with each session lasting 45–75 minutes. A semi-structured guide was used to explore challenges in addressing adolescent SBPs, preferred SmI features, and strategies for embedding Islamic values into DHIs. All interviews were audio-recorded with consent and transcribed verbatim.

Data analysis subsequently adopted Braun and Clarke's six-phase thematic approach (Braun & Clarke, 2006). The coding process combined a deductive approach, guided by the theoretical framework informed by behavioral and psychospiritual principles (e.g., privacy), with inductive coding to capture emergent features such as humor and lighthearted tone. Two researchers independently coded all transcripts in ATLAS.ti, then compared decisions, discussed discrepancies, and refined the codebook by merging, splitting, or redefining codes until consensus was reached.

Although a formal reliability coefficient was not calculated, consensus was prioritized to ensure intercoder reliability. This approach was chosen due to the exploratory nature of the study, where subjective interpretations of qualitative data required ongoing discussion and refinement. This iterative discussion successfully enhanced intercoder reliability, ensuring consistent application of codes. Themes were generated by clustering related codes, abstracting overarching patterns, and linking findings to the guiding theoretical constructs. Credibility was further supported through member checking with five participants, who confirmed that the interpretations reflected their perspectives (Lindheim, 2022). Appendix B summarizes how deductive and inductive coding informed the seven SmI features, connecting the coding process to the Results.

Regardless of the methodological approach, ethical approval was obtained from the UKM Research Ethics Committee (UKM PPI/111/8/JEP-2024-038). All participants received an information sheet outlining the study objectives and procedures, and written informed consent was obtained prior to data collection. Anonymity was maintained by replacing names with participant identification codes and removing any personally identifying information from the transcripts. For the web search phase, only public available information was used, and no personal data was collected.

C. Result and Discussion

The results are presented in two phases. Phase 1 reports findings from a web search mapping existing DHIs for adolescent in Malaysia and the neighboring countries. Phase 2 summarizes insights from expert interviews on culturally and spiritually relevant features for SmIs. Together, these phases provide a comprehensive view of current platforms and expert-informed design considerations for an Islamic-values-based SmI framework.

1. Result

a. Web search findings

A total of 53 digital health platforms met the inclusion criteria, with 26 based in Malaysia and 27 from Singapore, Brunei, and Indonesia combined.

As shown in Table 1, these platforms were distributed across seven categories: counseling and therapy centers (n = 10, 18.9%), government and university services (n = 8, 15.1%), private specialist services (n = 6, 11.3%), hotlines and crisis support (n = 1, 1.9%), faith-based services (n = 1, 1.9%), multi-issue or multi-country platforms (n = 19, 35.8%), and private specialist and thematic services (n = 8, 15.1%). Multi-issue platforms were the most common, whereas hotlines and faith-based platforms were least represented.

While these numbers provide a useful overview of platform distribution, they highlight the dominance of multi-issue platforms. These platforms cater to a broad range of health concerns but often lack the necessary cultural contextualization required for adolescent SBP. This gap particularly relevant in conservative Muslim contexts, where cultural and religious considerations must be integrated for interventions to be effective. The findings specifically reveal a significant scarcity of culturally specific platforms for SBP prevention, with specialized services like Islamic counseling being predominantly available only in Malaysia.

Table 1. Distribution of digital health platforms by category

No.	Category	N	%
1.	Counseling and therapy centers	10	18.9
2.	Government and university services	8	15.1
3.	Private specialist services	6	11.3
4.	Hotlines and crisis support	1	1.9
5.	Faith-based services	1	1.9
6.	Multi-issue, multi-country platforms	19	35.8
7.	Private specialist and thematic services	8	15.1
	Total	53	100

Beyond numerical distribution, the platforms revealed distinct design features and limitations. As shown in Table 2, counseling and therapy centers provided structured services but were often fee-based, which limits accessibility. In contrast, government and university services were free and more accessible, but their services frequently lacked the personalization needed for effective adolescent SBP prevention. This pattern underscores the need for more tailored, culturally sensitive interventions, especially in

conservative Muslim settings where personalized guidance and religious alignment are crucial for engagement.

Table 2. Key features and limitations of identified digital health platforms

No.	Category	Key Features	Limitations
1.	Counseling and therapy centers	Professional counseling, structured therapy programs, some with adolescent-specific services.	Often fee-based, limited free access, not always adolescent-friendly.
2.	Government and university services	Free access, broad outreach, integration with national health initiatives.	Limited personalization, bureaucratic interface, slow updates.
3.	Private specialist services	Tailored expertise, focus on mental/ sexual health, professional credibility.	Expensive, urban-centric, limited accessibility for rural adolescents.
4.	Hotlines and crisis support	Immediate response, 24/7 availability in some cases.	Reactive rather than proactive, limited follow-up, mostly phone-based only.
5.	Faith-based services	Integration of Islamic/ faith values, alignment with cultural expectations.	Very few platforms, lack of scalability, narrow focus.
6.	Multi-issue, multi-country platforms	Wide coverage, multilingual options, diverse adolescent health topics.	Limited contextualization for local culture, overwhelming information.
7.	Private specialist and thematic services	Focused on specific issues (e.g., sexual health, addiction, stress), innovative features.	Fragmented scope, not comprehensive, may lack holistic support.

In addition to these categorical insights, a cross-platform feature analysis revealed several common design elements. Notably, 39.6% of platforms incorporated chatbot functions, and 52.8% offered mobile applications in conjunction with web-based access, enhancing accessibility. Of the platforms reviewed, 58.5% were free. However, 22 platforms (41.5%) required paid subscriptions or session-based fees, with a notable regional variation in cost: 58.5% of platforms in Malaysia were free, whereas only 41.5% across Singapore, Brunei, and Indonesia offered similar accessibility. This regional disparity provides a clear example of a gap in equitable

access, illustrating the importance of affordable, culturally relevant DHIs. This affordability feature is currently less common across Singapore, Brunei, and Indonesia.

Across all four countries, platforms generally offered multimodal access (phone, video, chat, and email), though the extent of technological integration varied widely. Malaysia was the only country with a platform explicitly offering Islamic spiritual counseling, highlighting the cultural relevance of services in Muslim-majority settings. In contrast, platforms in Singapore, Brunei, and Indonesia incorporated advanced digital features like AI-powered chatbots, interactive self-help modules, and journaling tools, reflecting the technological advancements more frequently in these regions.

Despite these innovations, common barriers remained prevalent, including high service costs, limited language options, and privacy concerns, restricting accessibility, especially in rural or underserved areas. These findings are critical in understanding how DHIs can be optimized for diverse cultural contexts, illustrating the importance of affordable, culturally appropriate, and accessible services. Ultimately, while multi-issue platforms were most common, specialized services like Islamic counseling were more prevalent in Malaysia, underscoring the regional differences in digital health offerings and the importance of culturally tailored interventions for SBP prevention.

b. Interview findings

1. Demographic profile

Nine experts participated in the interviews and were Malay Muslims with direct experience in handling adolescent social issues, including SBP. Table 3 displays the demographic characteristics of the participants.

Table 3. Demographic characteristics of participants

Category	Frequency	Percentage (%)
Gender		
Male	4	44.4
Female	5	55.6
Age		
31 – 35	2	22.2

Category	Frequency	Percentage (%)
36 – 40	2	22.2
41 – 45	0	0
46 – 50	2	22.2
51 – 55	2	22.2
56 – 60	1	11.1
Educational level		
Degree	3	33.3
Master	2	22.2
PhD	4	44.4
Working sector		
Public	7	77.8
Private	1	11.1
Other	1	11.1

2. *Identified self-management intervention features*

Seven key features were identified as critical for designing a SmI for SBP prevention. Each feature is defined below, along with an illustrative quote and a summary of its rationale.

a) Privacy—Protecting user identity and maintaining confidentiality.
Quote: "*Confidentiality is key – clients' personal matters must never be exposed to the public*" (Interview with P01, March 2024)
Summary: Privacy reduces fear of judgement and encourages help-seeking.

b) Relaxation—A calm, approachable environment with easy-to-follow content.
Quote: "*It should feel like a relaxed forum, not overly formal*" (Interview with P05, March 2024)
Summary: Comfort-focused design supports sustained engagement.

c) Lighthearted Tone—Accessible language and friendly interaction styles.
Quote: "*Don't scare them with rigid demands – keep it user-friendly*" (Interview with P07, March 2024)
Summary: Informality lowers barriers and increases openness.

d) Catchiness—Quick visual and thematic appeal.
Quote: "*Make it catchy and in tune with their time*" (Interview with P06, February 2024).

Summary: Simple, attractive design helps capture attention.

e) Humor—Appropriate lighthearted content to ease defensiveness.
Quote: "*They enjoy funny content that still carries a profound message*" (Interview with P09, March 2024).
Summary: Humor fosters positive emotions and message retention.

f) Confidence-Boosting – Encouragement and prompt support to build self-belief.
Quote: "*Responses should be prompt, so users don't lose motivation*" (Interview with P01, March 2024).
Summary: Immediate feedback reinforces engagement.

g) Infographics—Visual formats for effective information delivery.
Quote: "*Adolescents like information in infographic form*". (Interview with P07, March 2024).
Summary: Visual media improve understanding and recall.

These findings directly inform the design of an Islamic-values-based SmI, offering key insights into how adolescents can be supported in addressing SBPs in a way that aligns with both psychospiritual principles and modern digital intervention strategies.

2. Discussion

The study indicates that a structured mapping of platforms, paired with expert insights, can surface design features that resonate with both adolescent engagement and cultural acceptability in conservative Muslim contexts. The seven key features identified—privacy, relaxation, lighthearted tone, catchiness, humor, confidence-boosting, and infographics—form a coherent design direction for SmIs aimed at preventing adolescent SBPs. Crucially, these features align with the study's objectives of integrating Islamic psychospiritual principles with behavioral science frameworks to design effective DHIs.

Framed within behavioral theory, these features add clarity on how a DHI can lower barriers to disclosure, reduce strain during use, sustain attention, and support behavior change while remaining aligned with Islamic norms around modesty, responsibility, and balanced expression. The

integration of PSD, TPB, and FBM, combined with Islamic principles, offers a holistic view of the mechanisms that drive user engagement and behavior change. For instance, the combination of privacy and relaxation features in DHIs not only reduces perceived barriers to disclosure (linking to PSD trustworthiness) but also enhances the user's sense of control (linking to TPB perceived behavioral control). This directly aligns with Islamic values of *ḥayā'* (modesty) and *amanah* (trustworthiness). Each of the seven identified features operates within these established frameworks, underscoring its importance in adolescent SBP prevention, particularly within faith-sensitive contexts.

To make the mechanisms of action explicit, each feature can be read through PSD, TPB, and FBM allowing understanding of the behavioral impact and cultural acceptability of these design elements:

1. Privacy—PSD trustworthiness/security; TPB perceived behavioral control; FBM ability; Islamic modesty (*ḥayā'*) and trustworthiness (*amanah*).
2. Relaxation—PSD primary task support; TPB positive attitudes; FBM motivation; Islamic peace (*sakīnah*).
3. Lighthearted tone—PSD dialogue support; TPB attitude formation; FBM motivation; Islamic balance in expression.
4. Catchiness—PSD tailoring/ suggestions; TPB behavioral activation; FBM prompts; Islamic reminders for good conduct.
5. Humor—PSD dialogue/social support; TPB attitude; FBM motivation; Islamic responsible joy within moral boundaries.
6. Confidence-boosting—PSD praise/ social learning; TPB perceived behavioral control and norms; FBM motivation; Islamic steadfastness (*istiqāmah*).
7. Infographics—PSD primary task support/simplification; FBM ability; TPB attitude shaping; Islamic clarity in knowledge (*bayān*).

These detailed mappings not only explain how each feature functions within behavioral frameworks but also clarify why these features are acceptable and effective in settings where faith, family, and community influence help-seeking behaviors and self-regulation.

Practical implications for DHI design follow directly from these findings. To respect privacy concerns, designers can prioritize private modes of access, clear consent flows, and anonymous use. Designers can also reduce cognitive effort and alleviate user stress by incorporating calming micro-interactions and visual summaries. Light-toned copy and measured humor are used to lower tension without crossing moral boundaries, craft memorable prompts and supportive feedback to build efficacy, and ensure transparent data practices and offline safety resources to address digital privacy.

Policymakers and service providers can play a critical role in fostering an ecosystem where digital health tools align with cultural and religious values (Kartono et al., 2024). For example, setting procurement benchmarks for privacy, bilingual coverage, and affordability can ensure that digital health solutions are inclusive and scalable across diverse regions. By fostering partnerships between health agencies, religious institutions, and technology designers, policymakers can ensure that interventions are not only effective but also culturally sensitive and sustainable.

Beyond Southeast Asia, the findings hold broader international relevance, especially in regions where Muslim adolescents face similar tensions between religious expectations and exposure to risky sexual behaviors. As highlighted by global literature, many countries experience the same challenges in adapting DHIs to fit faith-based and culturally sensitive contexts. For instance, Pakistan has seen the successful use of digital tools for adolescent mental health, but the effectiveness of these tools is heavily influenced by cultural and religious contexts (Farooqui et al., 2023; Rahmat et al., 2024). This aligns perfectly with the study's Islamic-values-based framework, which emphasizes the integration of psychospiritual principles into DHI design to enhance engagement in Muslim-majority populations globally.

In Saudi Arabia, research on e-health adoption reveals that cultural adaptation is essential for the successful implementation of digital health tools, particularly when addressing sensitive issues like SBP prevention (Alshammari, 2021). Recent trials there have also shown a clear need for contextualized well-being interventions targeting adolescents (Aljuboori et al., 2024). Similarly,

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trials in Jordan demonstrate that culturally adapted digital interventions for adolescent depression are not only acceptable but also relevant for improving adolescent well-being (Dardas et al., 2025). These findings reinforce the novelty in this study, as few interventions systematically combine behavioral science with religious frameworks, providing a more holistic approach to adolescent health.

Furthermore, studies from Indonesia show that digital interventions, such as internet-delivered mindfulness programs, have been successful in engaging adolescents by adapting to local cultural expectations (Listiyandini et al., 2023). This aligns with the key features identified in the current study—privacy, relaxation, and humor—which resonate well with adolescents, especially when grounded in Islamic principles of modesty, self-discipline, and balance.

These international studies collectively highlight the global shortage of digital interventions that successfully integrate religious principles and behavioral science. This research significantly fills this gap by providing a novel SmI design framework that is transferable across countries with similar faith-informed norms. This framework not only addresses SBP prevention in Muslim-majority countries but also offers concrete conclusions for global health policy and intervention design, reinforcing the importance of culturally sensitive and spiritually relevant digital health tools.

The present study has limitations, including its regional scope, which is confined to four Southeast Asia countries, and the potential omission of platforms outside the public web or behind closed groups. Moreover, the study relied solely on expert perspectives, which do not substitute for adolescent user testing. The current work also did not assess behavioral outcomes or long-term engagement. Future research should focus on testing prototypes that implement the seven identified features, including adolescents as co-designers and participants, to evaluate changes in attitudes, perceived control, intention, and behavior over time, as well as privacy experience and trust.

Taken together, the findings offer a clear, theory-anchored, and values-aware direction for DHIs that serve adolescents at risk of sexual behavior problems in conservative Muslim communities. The mapped mechanisms explain how and why specific features support engagement and self-management. The practical guidance helps teams build services that are usable and acceptable, while the international evidence indicates that the approach can be applied across countries with similar faith-informed norms. Ultimately, this work is a groundbreaking contribution to the design of persuasive technology and digital health for Muslim adolescents, providing clear paths for both implementation and evaluation.

D. Conclusion

This study successfully introduces a novel framework for designing DHIs aimed at preventing adolescent SBPs in conservative Muslim-majority contexts. By systematically mapping existing platforms across Southeast Asia and incorporating expert insights, we identified seven key features—privacy, relaxation, lighthearted tone, catchiness, humor, confidence-boosting, and infographics—that are both culturally relevant and theoretically grounded. When interpreted through the lenses of PSD, TPB, FBM, and Islamic psychospiritual principles, these features successfully operationalize faith-based values, thereby offering a culturally sensitive approach to SBP prevention.

The methodological contribution of this research lies in its integration of Islamic principles with established behavioral science frameworks, creating a practical and scalable design framework for DHIs. The theoretical contribution expands the scope of persuasive technology, demonstrating how religious values can enhance engagement and cultural acceptability in digital health solutions. This novel integration has not been explored systematically in existing literature, positioning the study as a unique contribution to both digital health and religious-based intervention design.

While this study's limitations include its regional focus and lack of adolescent user involvement, future research should prioritize co-design with

adolescents, pilot testing, and cross-cultural validation to extend the framework's global applicability. Longitudinal studies on behavioral outcomes, privacy experiences, and trust will be critical to validate the long-term impact of these interventions.

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Appendix A.

Search Strings and Keywords Used in the Web Search

The web search combined three main elements: (1) target group, (2) intervention type, and (3) content domain. Keywords were applied in both UK and US English spellings as well as Malay, using Boolean operators (AND, OR) to maximize coverage. Searches were adapted slightly depending on the portal or database but followed the same logic.

Table A1. Keyword groups used in the web search

Category	English (UK/US)	Malay
Target group	Adolescent, youth, teenager, young people	Remaja, belia, orang muda, pelajar
Intervention type	Digital health, online counselling/ counseling, self-management, mobile app, web-based intervention, e-health, m-health	Kesihatan digital, kaunseling dalam talian, pengurusan kendiri, aplikasi mudah alih, intervensi berasaskan web, e-kesihatan, m-kesihatan
Content domain	Sexual behavior/ behavior, risky behavior/ behavior, reproducetive health, Islamic values, spiritual counselling/ counseling, faith-based	Tingkah laku seksual, tingkah laku berisiko, kesihatan reproduktif, nilai Islam, kaunseling kerohanian, berasaskan agama

Table A2. Sample Boolean search strings

Language		Example Boolean Strings
English	1.	("adolescent" OR "youth" OR "teenager") AND ("digital health" OR "online counselling" OR "online counseling" OR "self-management" OR "mobile app") AND ("sexual behavior" OR "sexual behavior" OR "Islamic values" OR "spiritual counselling" OR "spiritual counseling")
	2.	("young people" OR "students") AND ("web-based intervention" OR "m-health" OR "e-health") AND ("risky behavior" OR "risky behavior" OR "faith-based" OR "religious counselling" OR "religious counseling")
Malay	1.	("remaja" OR "belia" OR "pelajar") AND ("kesihatan digital" OR "kaunseling dalam talian" OR "pengurusan kendiri" OR "aplikasi mudah alih") AND ("tingkah laku seksual" OR "nilai Islam" OR "kaunseling kerohanian")

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2.	("orang muda") AND ("intervensi berasaskan web" OR "e-kesihatan" OR "m-kesihatan") AND ("tingkah laku berisiko" OR "berasaskan agama")

Appendix B.

Deductive and Inductive Coding Leading to SmI Features

The coding process in Phase 2 (Expert Interviews) combined deductive codes derived from established behavioral and psychospiritual frameworks with inductive codes that emerged directly from expert insights. Table B1 illustrates how these two approaches informed the seven self-management intervention (SmI) features reported in the Results.

Table B1. Deductive and inductive coding leading to SmI features

Type of Code	Example Codes	Derived Themes	SmI Features Identified
Deductive (informed by behavioral and psychospiritual frameworks)	Attitude, Privacy, Confidence, Perceived behavioral control	Protecting adolescents' dignity and self-control; strengthening confidence and self-regulation	Privacy (privacy-by-design), Confidence-boosting
Inductive (emerged from expert interviews)	Humor, Lighthearted tone, Catchiness, Relaxation, Infographics	Making interventions engaging, relatable, and user-friendly for adolescents	Humor, Lighthearted tone, Catchiness, Relaxation, Infographics