Models, Constructs, and Methods in mHealth User Experience Research: A Systematic Review

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Abstract

The global mobile health (mHealth) market is rapidly expanding, with user experience (UX) crucial for user retention. However, previous studies have mostly focused on usability and paid little attention to UX perspective. This review systematically examines theoretical models, UX constructs, and methodological approaches in mHealth UX research. A systematic literature review (SLR) across 12 databases yielded 6,739 records; 43 empirical studies met inclusion criteria. In accordance with SLR guidelines, data were extracted and synthesized, followed by qualitative analyses. Only three studies applied UX models, indicating that theory-driven approaches remain limited in this field. In contrast, most studies relied on standardized questionnaires, through which thirty unique UX constructs were identified, with commonly examined constructs including Information Quality, Aesthetics, and Attractiveness, and less frequently studied constructs including Privacy, Utility, Flexibility, Complexity, and Context. All studies employed mixed methods. This review demonstrates that UX research in mHealth remains fragmented, with limited theoretical grounding, uneven construct coverage, and methodological reliance on questionnaires. Addressing these gaps requires integrating theory-driven models with context-sensitive evaluation tools, paving the way for more rigorous, inclusive, and practically relevant mHealth solutions.

Keywords: *User Experience (UX), Mobile Health(mHealth) Applications, Smartphone, Systematic Literature Review (SLR)*

1. Introduction

The global mobile health (mHealth) applications market, valued at $36.68 billion in 2024, is projected to grow significantly from $40.65 billion in 2025 to $88.70 billion by 2032, at a compound annual growth rate (CAGR) of 11.8% [1]. Despite this rapid expansion, empirical studies indicate alarmingly low sustained usage rates. For example, [2] demonstrated that mHealth applications often experience critically low engagement, as evidenced by a mean usage duration of only 4.1 days and an estimated attrition rate of 71% within 90 days. These challenges are frequently attributed to systemic issues in app design, such as insufficient motivational features or lack of user support, technical barriers, and participant-related factors including the involvement of non-clinical populations and limited perceived relevance.

In chronic disease management, [3] reported that up to 98% of users discontinued app use within a short period, making engagement clinically ineffective. High attrition thus remains a major obstacle for app-based interventions, particularly in real-world settings, where low usability and insufficient user satisfaction can lead to early discontinuation. [4] further emphasized that UX metrics such as usability and satisfaction are critical for fostering engagement and long-term retention. Although tools like the System Usability Scale (SUS) are widely used, empirical evidence directly linking SUS scores to attrition rates is still limited, highlighting the need for further research.

In response to these challenges and research gaps, the present study aims to systematically analyze theoretical models, core constructs, and research methodologies employed in existing mHealth application UX research, while synthesizing key empirical findings.

2. Background

2.1. Definitions of Mobile Health Applications

Mobile health (mHealth) is defined as the "medical and public health practice supported by mobile technologies" [5]. With the integration of healthcare informatization and communication technologies, mHealth has become an integral part of daily life, enabling individuals to collect and manage their health data anytime and anywhere [6], [7]. Reliance on mHealth for health consultations and online medical advice has driven rapid expansion of the global mHealth market. The advantages of mHealth encompass promoting healthy behaviors, preventing or mitigating health issues, assisting individuals with chronic conditions in managing their health independently, and enabling real-time communication with healthcare professionals [8]. In this review, mHealth applications specifically refer to mobile-based health applications, particularly those designed for smartphones or tablets.

2.2. Concepts of User Experience

User Experience (UX) is a key quality metric in mobile application design [9]. UX is a multidimensional and comprehensive concept encompassing the entire process of interaction between users and products or services. According to ISO 9241-110:2020 [10], UX represents "a combination of user's perceptions and responses that result from the use or anticipated use of a system, product or service." Crucially, UX differs from usability. While usability focuses on goal-related interactions between users and products, UX encompasses a broader range of user responses, including emotions, preferences, and behaviors [11].

In summary, mHealth applications are becoming increasingly important in healthcare, and UX plays a crucial role in their effectiveness, adoption, and sustained use. Despite this, there is still no consensus on how UX should be conceptualized or evaluated in this context. This highlights the need for a Systematic Literature Review (SLR). The next section presents the methodology, following established SLR guidelines to ensure rigor and transparency.

3. Literature review methodology

This study adopts the SLR methodology proposed by [12], which is widely recognized in software engineering and increasingly adopted in health informatics [13]. The literature review process is divided into three stages, as shown in Figure.1: planning, conducting, and reporting.

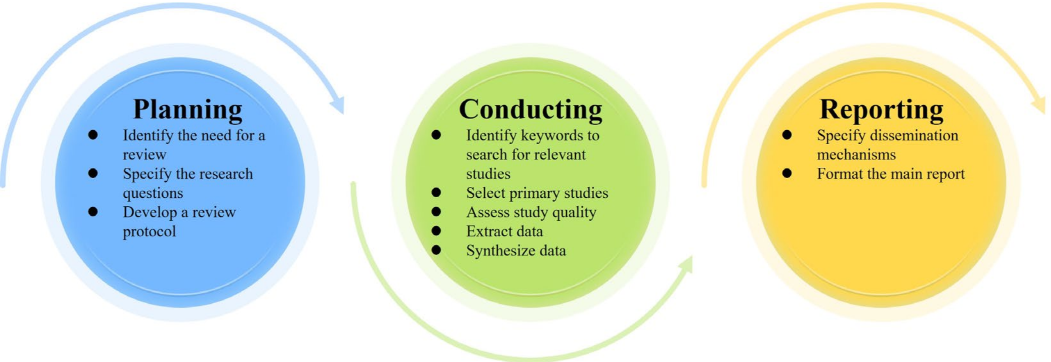

Figure 1. General Process of the Adapted SLR

3.1. Research Need Identification, Question Formulation, and Protocol Development

A preliminary screening showed that prior reviews on mHealth UX focused on specific areas, such as usability [14], without systematically addressing theoretical models, core constructs, or research methods. To fill this gap, this study formulates three questions:

i. Which theoretical models explain UX in mHealth applications?
ii. What core constructs are commonly examined?
iii. What research methods are employed?

Following the SLR protocol of [12], a systematic search was conducted across twelve databases (Web of Science, PubMed, IEEE Xplore, Taylor & Francis, Wiley, Sage, ACM, Oxford, Scopus, Embase, ScienceDirect, CINAHL). Core keywords were used, including “user experience,” “UX,” “mobile health applications,” “mHealth apps,” and “smartphone health applications.” Boolean operators and field-specific limits were also applied. Inclusion criteria covered empirical English research using quantitative or mixed methods on UX models, constructs, or methods. Review papers, usability-only studies, wearable-only studies, and non-English studies were excluded. Data were exported, duplicated, screened, and analyzed, with cross-verification against the original studies to ensure accuracy and reliability.

3.2. Study search, selection, quality assessment, data synthesis

The literature search followed an iterative refinement process. The initial query was (“user experience” OR UX) AND (“mobile health applications” OR “mHealth apps” OR “smartphone health applications”). It retrieved 244 records from Scopus. Following the recommendation of [15] that a systematic review should capture as many relevant studies as possible, the search strategy was further expanded. The expanded query was (“user experience” OR UX) AND (mHealth OR “mobile health” OR “mobile health applications” OR “mHealth apps” OR “smartphone health applications”). It yielded 966 records and substantially broadened the scope of relevant studies. The final search was conducted across 12 databases between March 1 and April 30, 2025. It applied the finalized selection framework, four inclusion and six exclusion criteria (see Table 1), including added exclusions for COVID-19 contact-tracing apps and studies limited to healthcare professionals or medical students. No publication date restriction was applied, and only studies meeting all inclusion and none of the exclusion criteria were retained.

Table 1. Inclusion and Exclusion Criteria for Studies on UX of mHealth Applications

Inclusion Criteria	Exclusion Criteria
· Study content addresses UX models (including measurement or evaluative models). · Studies that employed quantitative or mixed methods research designs. · Study subject is mHealth application. · Study type is belonging to original studies.	· Studies limited to usability or feasibility, with no focus on UX. · Studies focusing on COVID-19 tracking applications. · Study population consists exclusively of healthcare professionals, Medical Students. · Studies that are review articles or lack original data. · Studies excluded wearable devices. · Non-English publications.

Figure 2 illustrates the study selection process in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram (http://www.prisma-statement.org/). It details each stage of the literature screening. This process resulted in the inclusion of 43 studies in the final review.

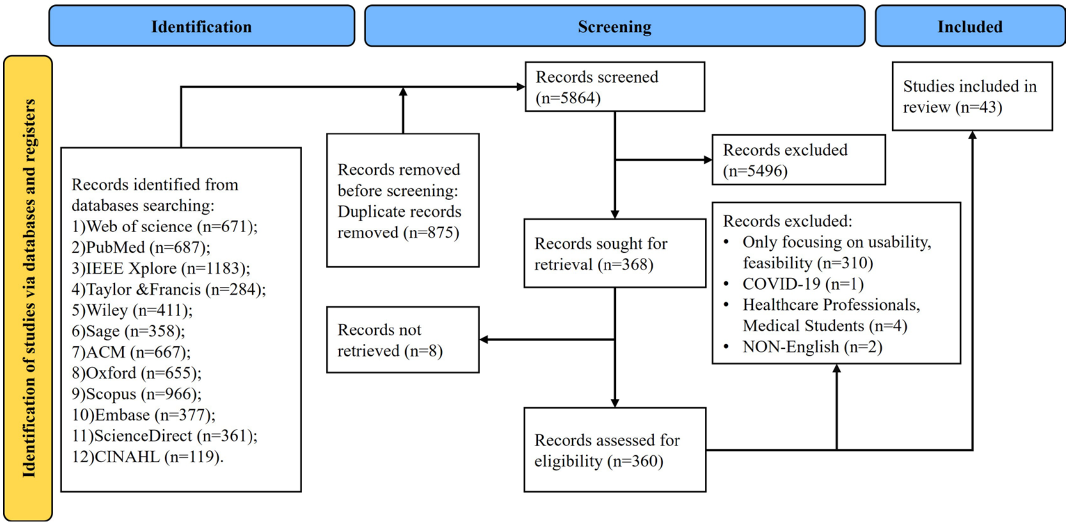

Figure 2. PRISMA Flow Diagram of Study Selection for UX in mHealth Applications

After study selection, quality assessment (QA) was assessed using five criteria adapted from [12] covering relevance, context, and methodological rigor. Each study was scored on a 3-point scale (1 = fully, 0.5 = partially, 0 = not satisfied; max = 5), with those <1 excluded and 1–3 rated as medium quality and retained. Based on the five QA questions, 22 studies achieved the maximum score of 5, while the remaining 21 scored 4.5, indicating that all studies met the quality threshold and satisfied the inclusion criteria.

For the synthesis process, the selected studies' PDF files were uploaded to the AI tool DeepSeek to extract information on UX models, constructs, and research methods. The extracted data was recorded in Excel and cross-checked with the original PDFs for accuracy. Any errors or incomplete information were manually corrected in the Excel file, with cross-verified results against original articles. The reporting stage addressed the three research questions, with Section 4 detailing the included studies.

4. Results

This section synthesizes findings from the 43 included studies. It then examines theoretical models, key UX constructs, and the methodological approaches and instruments used for assessment.

4.1. Overview of Included Studies

Table 2 summarizes 43 studies on UX in mHealth applications. For each study, it includes the authors (reference), key findings. The key findings were synthesized into two components. One is UX evaluation, reporting overall UX quality (positive, mixed, moderate, or negative) and detailing specific strengths and weaknesses. The other is evidence-based recommendations for improving mHealth application design and functionality.

Table 2. Summary of 43 Included Studies on UX in mHealth Applications

No.	Author (Reference)	Key Finding
P01	(Naccache et al., 2021) [16]	Mixed; strong aesthetics; limited personalization, emotional and social barriers.
P02	(Böttinger et al., 2023) [17]	Positive; high usability and accessibility; strong pragmatic and hedonic qualities.
P03	(Lobo et al., 2023) [18]	Negative; crashes, poor navigation, privacy concerns, outdated design.
P04	(Sporrel et al., 2022) [19]	Mixed; high aesthetics, moderate usability; low perceived effectiveness and satisfaction.
P05	(S. M. Kim et al., 2020) [20]	Positive; strong engagement, functionality, and accessibility; constrained by complex terminology and limited integration.
P06	(G. Kim et al., 2024) [21]	Moderate; usable design, improved visuals; satisfaction affected by complex information and overlapping functions.
P07	(Hussain & Lee, 2017) [22]	20-dimension UX framework proposed from user reviews.
P08	(Muuraiskangas et al., 2016)[23]	Mixed; excellent usability; intention to use declined due to content mismatch.
P09	(Anastasiadou et al., 2019) [24]	Positive; easy to use, useful, visually appealing; personalization issues reduced satisfaction.

No.	Author (Reference)	Key Finding
P10	(Ball et al., 2020) [25]	Moderate; convenient and flexible; technical barriers and underused modules limited adoption.
P11	(Rodante et al., 2022) [26]	Mixed; strong pragmatic quality and usability; weak hedonic quality limited engagement.
P12	(Beutter et al., 2023) [27]	Positive; high usefulness and clarity; efficiency issues constrained experience.
P13	(Sakib et al., 2024) [28]	Positive; high satisfaction with usability, information organization, and pragmatic-hedonic balance.
P14	(Mukta et al., 2025) [29]	Positive; usability and UX quality rated well; interface complexity limited long-term use.
P15	(Quaedackers et al., 2020) [30]	Mixed; strong functional performance and attractiveness; limited hedonic quality and innovation.
P16	(Kurnia et al., 2024) [31]	Moderate; reliable functionality boosted diabetes confidence; lacked personalization, technical content.
P17	(Shetty et al., 2021) [32]	Mixed; strong functionality, beginner-friendly; limited customization and scalability constrained long-term use.
P18	(Becker et al., 2022) [33]	High; strong information, credibility, perceived usefulness; limited engagement.
P19	(Mehdi et al., 2020) [34]	Mixed; strong aesthetics and functionality; most apps lacked scientific evidence (only 7 evidence-based).
P20	(Herbuela et al., 2021) [35]	Positive; high engagement, authoritative content; low long-term intent due to functional limits.
P21	(Bakogiannis et al., 2021) [36]	Positive; strong aesthetics, functionality, information quality; interface usability required refinement.
P22	(Petrocchi et al., 2021) [37]	Positive; UX, content, and design enhanced psychological empowerment; trust and synchronization limited.
P23	(Walia et al., 2024) [38]	Mixed; strong functionality; moderate engagement; ToothSOS rated best.
P24	(Rezaee et al., 2022) [39]	Positive; high usability and clinical utility; engagement limited, especially among older users.
P25	(Woods et al., 2019) [40]	Moderate; solid navigation and design; Android issues, low interactivity, weak behavioral impact.
P26	(Sanders et al., 2023) [41]	Moderate; stable functionality supported strong behavioral influence, high future use intent; engagement low.
P27	(Hamrioui et al., 2018) [42]	Positive; high perceived usefulness, ease of use, acceptable visual design.
P28	(Kalimullah & Sushmitha, 2017) [43]	Positive; simple, guided interface enhanced usability; technological anxiety remained a barrier for elderly users.
P29	(Tonga et al., 2021) [44]	Exceptional; perfect usability, effortless operation, high satisfaction.
P30	(Schröder et al., 2024) [45]	Mixed; high usability and functional adequacy; monotonous design, low engagement.
P31	(Willems et al., 2021) [46]	Moderate; adequate usability; lacked personalization, clinician interaction, pain management guidance.
P32	(Machetanz et al., 2024) [47]	Positive; excellent usability and simplicity; low functional diversity.
P33	(Wulandari et al., 2022) [48]	Positive; all dimensions positive; educational value highest, novelty needs improvement.
P34	(Parmar et al., 2024) [49]	Positive; good usability and engagement; efficiency and perceived novelty weaker.
P35	(Ismail et al., 2022) [50]	Moderate; good usability and learnability for emotional management; limited interaction quality.
P36	(Shi et al., 2021) [51]	Mixed; strong learnability; usability and satisfaction limited by content relevance.
P37	(Volpi et al., 2021) [52]	Positive; high satisfaction from pragmatic utility, attractiveness, gamification.
P38	(Truong et al., 2022) [53]	Positive; strong hedonic quality and attractiveness; perspicuity was main pragmatic limitation.
P39	(Salari et al., 2021) [54]	Positive; good functional performance; limited visual appeal affected experience.
P40	(Mehdizadeh et al., 2023) [55]	Mixed; attractive and efficient interface; limited innovation constrained long-term engagement.
P41	(Wicahyono et al., 2019) [56]	Moderate; above-average UX scores; novelty and efficiency weakest.
P42	(Kumaladewi et al., 2024) [57]	Positive; strong clarity and efficiency; limited novelty.

No.	Author (Reference)	Key Finding
P43	(Rodrigues et al., 2023) [58]	Positive; strong pragmatic performance and attractiveness; limited hedonic quality and self-monitoring features.

4.2. Research models for UX of mHealth applications

Among the reviewed studies, only three explicitly applied theoretical UX models. Hassenzahl's model and Components of user experience (CUE-Model) were used by [16] to structure interviews. [17] and [18]applied the UX Honeycomb model for qualitative analysis. These models were likely chosen for their complementary focus. Hassenzahl's model [59] distinguishes pragmatic (utility, usability) and hedonic (stimulation, identification, evocation) attributes their emotional consequences. The CUE-Model [60] integrates instrumental, non-instrumental, and emotional qualities in user–system–context interactions. The UX Honeycomb model [61] provides seven foundational design dimensions for evaluation. In contrast, other Human-Computer Interaction (HCI) models, such as the framework of Quality of Experience (QoE) [62], were less frequently applied. This is likely because they emphasize system quality over the full spectrum of UX, including emotional and contextual aspects critical to mHealth. This limited adoption highlights a gap in systematically applying established UX frameworks, suggesting the need for more comprehensive integration of diverse UX perspectives.

4.3. UX Constructs in mHealth applications

Table 3 summarizes 30 groups of UX constructs identified in empirical mHealth studies. It includes their definitions, related theories or theoretical models, measurement instruments, frequency of use, and relevant references. Similar constructs were consolidated under unified labels. The frequency of each construct was counted only once per study. Definitions were further cross-checked and supplemented by using relevant literature to ensure accuracy. This explains why the number of references may exceed the actual number of studies.

In addition to frequency analysis, the "Theory/ Model; Questionnaires" column in Table 3 also shows that some constructs overlap with established theoretical models. These overlaps exist between UX dimensions and established theoretical models. For example, Information Quality is a key construct in the DeLone and McLean Information Systems Success Model (D&M ISM) [63]. Similarly, Ease of Use and Intention to Use correspond to constructs in the Technology Acceptance Model (TAM) [64]. Utility is conceptually similar to TAM's Usefulness. Moreover, Privacy is a central construct in the Privacy Calculus Model (PCM) [65]. These overlaps demonstrate that several UX constructs are conceptually grounded in established theoretical models.

Table 3. Commonly Used UX Constructs, Definitions, and Sources in mHealth Application Studies

Extracted Constructs	Definition/ Description	Theory/ Model; Questionnaires	Usage in Studies (Reference)
Information Quality/Informativeness/Ea	Accuracy, timeliness, completeness, relevance, and consistency were the criteria	D&M ISM; e-Health Impact Questionnaire (eHIQ)/Post-Study Syste	17 [20], [21], [22], [26], [28], [32], [33], [34], [35],

Extracted Constructs	**Definition/ Description**	**Theory/ Model; Questionnaires**	**Usage in Studies (Reference)**
se of Information/ Information Architecture	used to evaluate the quality of the information.	m Usability Questionnaire (PSSUQ)	[36], [37], [38], [39], [40], [41], [45], [46], [63]
Aesthetics/Appearance/Design	A product's sensory experience and its alignment with personal goals and preferences.	CUE-Model; Mobile Application Rating Scale (MARS)/ user version of the Mobile App Rating Scale (uMARS)/Quality of Experience (QoE) assessment/Visual Aesthetics of Websites Inventory (VisAWI)/Visual Aesthetics of Apps Inventory (VisAAI)	16 [19], [21], [24], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41], [42], [45], [47], [60]
Attractiveness / Appeal/ Desirable	The visual esthetics of the system need to be attractive and easy to translate.	UX Honeycomb Model; User Experience Questionnaire (UEQ)/User Experience Questionnaire–Short Version (UEQ-S)	16 [16], [17], [18], [30], [33], [43], [45], [48], [49], [52], [53], [54], [55], [56], [57], [58], [61], [66]
Usability/ Usable/Interface/Interaction	Refers to how easily a user can interact with a tool or system.	UX Honeycomb Model; SUS/mHealth app usability questionnaire (MAUQ)	16 [17], [18], [19], [23], [29], [30], [31], [36], [37], [38], [39], [43], [44], [45], [46], [47], [67]
Pragmatic Quality	Refers to a software's usefulness, expressed by product characteristics such as "clear", "supporting", and "controllable".	Hassenzahl's model; AttrakDiff User Experience Questionnaire (AttrakDiff)	13 [16], [17], [26], [28], [29], [30], [52], [53], [54], [55], [56], [57], [58], [68]
Ease of Use/ Simplicity	The degree to which someone thinks utilizing medical applications would be effortless.	TAM; MAUQ/Usefulness, Satisfaction, and Ease of Use Questionnaire (USE)/VisAWI/VisAAI	13 [21], [22], [24], [25], [27], [28], [31], [42], [43], [44], [45], [50], [51], [64]
Efficiency/ Efficient/ Effective	The system should be efficient, enabling users to perform tasks quickly and with minimal effort once they have learned to use it.	UEQ/UEQ-S /SUS	13 [16], [22], [27], [43], [48], [49], [52], [53], [54], [55], [56], [57], [58], [66], [67]
Engagement/ Flow/ Attachment	Engagement is a UX quality characterized by user interest, motivation, interactivity, feedback, and emotional involvement.	MARS/uMARS	13 [20], [22], [26], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41], [69]
Usefulness/ Useful/Valuable	A system's perceived value in fulfilling user needs and delivering practical solutions.	UX Honeycomb; MAUQ/e-Health Impact Questionnaire (eHIQ)/USE/ Intrinsic Motivation Inventory (IMI)	13 [17], [18], [19], [21], [23], [24], [27], [28], [33], [36], [43], [50], [51], [61]
Dependability/ Clarity	Users' sense of control, predictability, and trust in the system's behavior.	UEQ/UEQ-S	12 [16], [22], [27], [48], [49], [52], [53], [54], [55], [56], [57], [58], [66]
Hedonic Quality	Refers to quality aspects such as "innovative", "exciting", and "exclusive".	Hassenzahl's model; AttrakDiff	12 [16], [17], [28], [29], [30], [52], [53], [54], [55], [56], [57], [58], [68]
Stimulation/ Motivation/Rewarding	The system's ability to be engaging, motivating, and emotionally appealing.	Hassenzahl's model; UEQ/UEQ-S	12 [16], [22], [46], [48], [49], [52], [53], [54], [55], [56], [57], [58], [66]
Perspicuity/ Comprehensibility	The ease with which users understand how to use the application.	Hassenzahl's model; UEQ/UEQ-S	11 [16], [22], [48], [49], [52], [53],

Extracted Constructs	**Definition/ Description**	**Theory/ Model; Questionnaires**	**Usage in Studies (Reference)**
			[54], [55], [56], [57], [58], [66]
Functionality	A set of attributes related to the functions of a system that fulfill stated or implied user needs.	MARS/uMARS	10 [20], [32], [33], [34], [35], [36], [38], [39], [40], [41], [70]
Novelty	Perceived innovativeness and originality of the system; how new or creative it feels to users.	Hassenzahl's model; UEQ/UEQ-S	10 [16], [48], [49], [52], [53], [54], [55], [56], [57], [58], [66]
Satisfaction/ Recommendation	To promote satisfaction, the system should be simple and engaging.	Hassenzahl's model/ CUE-Model; SUS/MAUQ/USE	9 [19], [21], [22], [23], [24], [37], [44], [50], [51], [67]
APP Subjective /Specific Quality	Users' holistic assessment combining subjective impressions and goal fulfillment effectiveness.	MARS/uMARS	7 [32], [35], [36], [38], [39], [40], [41], [71]
Content/Quality of Content	Users' perception of the quality of the content offered by the mobile application.	QoE	6 [23], [24], [27], [31], [37], [42], [72]
Credible/Credibility/Trust	The creator or provider of the system must be reliable.	UX Honeycomb Model; eHIQ	5 [17], [18], [27], [33], [37], [61]
Ease of Learning /Learnability	The system is easy to learn, allowing users to quickly understand and operate it.	UX Honeycomb Model; QoE/Questionnaire for User Interface Satisfaction (QUIS)	5 [22], [37], [43], [50], [51], [67]
Perceived Impact/Perceived Effect	Refers to the belief that using a system enhances task performance or leads to desirable outcomes.	uMARS	5 [22], [31], [32], [33], [41]
Accessible/Accessibility	The system should enable users with impairments to have the same experience as others.	UX Honeycomb Model	4 [17], [18], [22], [43], [61]
Confidence/ Competence	Users believe that their confidence in talking about and taking care of their health has changed as a result of visiting the website.	eHIQ	3 [22], [32], [46], [73]
Findable	The systems' features must be accessible and simple to use.	UX Honeycomb Model	2 [17], [18], [61]
Intention of/to Use	Explain a person's motivation for utilizing or embracing a behavior; in this instance, that activity is the use of a mobile health app.	TAM	2 [20], [23], [74]
Privacy/Safety /Security	Refer to the protection of personal health data and control over its access and use.	PCM	2 [24], [43], [65]
Utility/Convenience	Refers to how easily a feature improves task performance with minimal time and effort.	TAM	2 [25], [33], [64]
Flexibility	Ease to change the content or format of the data to meet changing business needs.	Task-Technology Fit (TTF)	2 [22], [25], [75]
Complexity/Disorientation	Spatial confusion and cognitive overload from complex, nonlinear navigation structures.	AttrakDiff, Modular Evaluation of Key Components of User Experience (meCUE)	1 [22], [76]
Context	Information describing a user's or system's state relevant to their interaction.	HCI	1 [22], [77]

As shown in Table 3, half of the UX constructs were identified in more than ten studies. The most frequently examined construct was Information Quality/ Informativeness/ Ease of Information/ Information Architecture, appearing in 17 studies. This was closely followed by Aesthetics/ Appearance/ Design, Attractiveness/ Appeal, and Usability/ Interaction (16 studies each). A further group of constructs were reported in 13 studies. These included Pragmatic Quality, Ease of Use/ Simplicity, Efficiency/ Effectiveness, Engagement/ Flow/ Attachment, and Usefulness/ Value. Slightly fewer studies addressed Dependability/ Clarity, Hedonic Quality, and Stimulation/ Motivation/ Rewarding (12 studies), Perspicuity/ Comprehensibility (11 studies), and both Functionality and Novelty (10 studies each).

By contrast, several constructs appeared rarely. Findability, Intention to Use, Privacy/ Safety/ Security, Utility/ Convenience, and Flexibility were each identified in only two studies. Notably, Privacy/ Safety/ Security is critical in mHealth due to sensitive health data. However, it remains under-researched. This may be because studies focus more on usability, aesthetics, and engagement than on data protection as an experiential construct. The least examined constructs were Complexity/ Disorientation and Context, reported only once.

4.4. Methods for User Experience of mHealth Applications

Table 4 presents the distribution of research methodologies across the reviewed studies. To achieve consistency, and following established methodological classifications [12], [78], [79], the studies were grouped into eight categories. Although some papers used the term "scale" instead of "questionnaire," this review consistently applies "questionnaire" for clarity, while retaining the original terminology in the table.

Table 4. UX Evaluation Method Categories and Corresponding Studies in the SLR

Method Category	Method/ Instrument	Number of Studies (References)
Questionnaires and Surveys	Questionnaire	28 [16], [19], [20], [21], [24], [26], [27], [28], [29], [30], [33], [35], [36], [37], [39], [41], [42], [45], [47], [50], [51], [52], [53], [54], [55], [56], [57], [58]
	Scales	8 [31], [32], [38], [40], [43], [44], [49], [55]
	UX questionnaires	1 [23]
	Open-ended Survey	2 [29], [31]
	Cross-sectional online Survey questionnaire	2 [46], [48]
	Open-ended questions	2 [23], [50]
Interviews	Semi-structured Interview	11 [19], [23], [25], [32], [35], [37], [40], [43], [44], [45], [49]
	In-depth Interview	3 [20], [21], [30]
	Semi-structured discussion	1 [17]
Focus Groups and Expert Methods	Focus group discussions	8 [16], [24], [25], [27], [35], [41], [44], [49]
	Expert consultation/evaluation	2 [54], [56]
	Stakeholder engagement	1 [28]

Method Category	Method/ Instrument	Number of Studies (References)
	Delphi process	1 [36]
	Nominal group technique (NGT)	1 [39]
User Feedback and Reviews Analysis	User feedback	5 [26], [28], [36], [47], [52]
	Open-ended feedback	3 [33], [42], [55]
	User review/comment analysis	2 [33], [57]
Usability and User Testing	User testing	3 [21], [35], [50]
	Usability testing	2 [27], [53]
	Heuristic evaluation	2 [38], [58]
	Think-aloud	2 [45], [53]
	Quasi-experiment: using task testing	1 [43]
	Hands-on activities	1 [17]
	User behavior observation and feedback collection	1 [56]
	Contextual inquiry	1 [49]
Usage Data Analysis	Usage logs	2 [23], [32]
	User behavior data	2 [30], [51]
	Log data analysis	1 [33]
	Remote support logs	1 [52]
Analytical Methods	Thematic analysis	5 [18], [31], [32], [46], [48]
	Content Analysis	4 [18], [38], [51], [55]
	Sentiment analysis	1 [18]
	TF-IDF+K-means	1 [18]
	LDA-based UX dimension extraction (User review)	1 [22]
Experimental Studies	Randomized controlled trial (RCT)	2 [24], [26]
	Randomized feasibility trial (RFT)	1 [25]

It shows that questionnaires (37 studies, 86%), interviews (15 studies, 35%), and focus group discussions (8 studies, 19%) were the most employed methods for UX evaluation in mHealth research. In addition, qualitative approaches such as user feedback/ review analysis (10 studies, 23%), thematic analysis (5 studies, 12%), and content analysis (4 studies, 9%) were widely used to capture user perspectives beyond numerical scores. Methods directly observing user interaction, such as think-aloud protocols, heuristic evaluation, and usability testing (6 studies, 14%), also contributed to a more nuanced understanding of UX.

Beyond traditional methods, emerging computational approaches point to a growing trend of data-driven assessment. These include remote log analysis, sentiment analysis, and LDA-based UX dimension extraction. Although experimental designs were relatively few, they provided valuable causal evidence under controlled or real-world conditions. Overall, self-reported measures remain central in UX evaluation. They are often complemented by behavioral and qualitative data. This reflects an increasing tendency toward methodological integration and triangulation.

5. Discussion

This study employed a SLR to examine 43 articles related to UX in mHealth applications. This section interprets the core findings of the review, including insights that inform potential directions for future research, and discusses the study’s limitations.

5.1. Principal Findings and Future Research Directions

To the best of our knowledge, few comprehensive systematic reviews have examined UX in mHealth applications from the perspectives of theoretical models, UX constructs, and research methodologies. The findings of this review address these research dimensions and the corresponding research questions.

(1) Theoretical Models

This review reveals that the application of UX theoretical models in mHealth research remains relatively limited. Researchers' use of models appears more like practical borrowing or adaptation at the tool level rather than genuine theoretical advancement. Relying on readily available tools like SUS or UEQ, rather than grounding research in explicit UX theory, may lead to fragmented findings. It may also overlook deeper constructs, such as privacy, safety and security, and hinder the development of a coherent theoretical framework. The UX Honeycomb model, due to its strong operational practicality, has been more frequently adopted, whereas Hassenzahl's model and the CUE Model, though widely applied in other HCI domains such as website design [80], virtual reality [81], e-Learning [82], and in-vehicle technology [83], have been scarcely used in mHealth. This suggests a tendency to favor pragmatic, readily applicable instruments, such as UEQ, SUS, and MARS, over explicitly theory-driven exploration. This may in turn limit explanatory power and theoretical depth.

Consequently, existing studies often focus on surface-level experiences such as usability and satisfaction. They may potentially underrepresent critical aspects like emotional engagement, trust, and long-term usage intention. Hassenzahl's pragmatic–hedonic dual framework provides greater explanatory power. The CUE-Model also offers an integrative perspective on instrumental qualities, non-instrumental qualities, and emotional dimensions. Without broader adoption of these frameworks, mHealth UX research risks remaining under-theorized and may not fully capture the complexity of UX.

From a practical standpoint, several directions deserve further attention. First, theoretically, researchers should compare the adaptability of different models in healthcare contexts and examine their relationships with user adherence. Second, methodologically, cross-cultural validation of instruments such as AttrakDiff [84] and meCUE [85] is needed. Third, in practice, hybrid strategies that integrate rapid questionnaires with theory-based instruments should be developed. Such approaches have already been applied in domains such as e-learning [82] and virtual reality [81] to balance efficiency and explanatory depth. Incorporating frameworks such as Hassenzahl's model and the CUE model can further strengthen both academic understanding and design practice.

(2) UX Constructs Analysis

This systematic review identified a total of 30 UX constructs relevant to mHealth applications. This finding stands in sharp contrast to the current heavy reliance on standardized questionnaires with limited dimensional coverage. This focus on frequently measured, easily quantifiable constructs results in critical but less frequently studied dimensions being systematically overlooked.

Information Quality, Aesthetics, Attractiveness, and Usability are the most frequently examined UX constructs in mHealth applications, consistent with prior research. Less frequently studied constructs include Findability, Intention to Use, Privacy/ Safety/ Security, Utility/ Convenience, Flexibility, Complexity/ Disorientation, and Context. These constructs are also highly relevant and warrant greater attention. Several of these low-frequency constructs reflect the core characteristics of mHealth applications. For example, Privacy and Security [18] are essential for protecting sensitive health data, particularly in clinical and patient-care contexts. Context [22] is critical for adaptive and personalized experiences. Their underrepresentation highlights the limitations of standardized questionnaires. These questionnaires may overlook or insufficiently capture key dimensions, leaving important evidence accessible only through user review mining or big data analytics. Moreover, the frequency of constructs is also shaped by the maturity of available instruments. For instance, widely used questionnaires such as UEQ, SUS, and MARS were developed earlier and are frequently adopted. More recent tools like the MAUQ [86] have not yet been as widely applied. This partially explains why some constructs remain underexplored.

From a practical perspective, future research should focus on three areas. First, theoretical integration of UX constructs with models such as D&M ISM, TAM, PCM, and TTF to form comprehensive frameworks. This is particularly important when combining user experience and technology acceptance models. These approaches have already shown meaningful outcomes in other domains and merit adaptation in the mHealth context. Second, methodological advancement through the development of instruments that capture low frequency but essential constructs. Third, practical efforts to strengthen empirical work on privacy and contextual adaptation to ensure user benefits. Systematic integration with empirical validation may ultimately yield UX–acceptance models that are both more explanatory and practically valuable.

(3) Characteristics of Research Methods

This review finds that all 43 included studies adopted mixed methods. This reflects their value in combining the breadth of quantitative data with the depth of qualitative insights. Methodological imbalances remain. Nearly 90% of quantitative studies relied on questionnaires, while few used data mining or behavioral analysis. Current research remains heavily dependent on self-reported questionnaires. It favors streamlined assessments that prioritize speed over contextual depth. Longitudinal tracking and real-world data collection are largely underutilized.

Although efficient, questionnaires such as UEQ offer limited scope. This leads some studies to combine multiple tools, e.g., [21], [28].This underscores the lack of systematic, context-specific instruments. Qualitative approaches, including interviews, focus groups, user feedback, and usability testing, complement these methods. User review analysis proves particularly useful for identifying novel UX constructs. Experimental designs such as RCTs have been attempted but remain rare due to recruitment and resource challenges. This limits the transferability and robustness of UX research when translated into clinical practice or large-scale health applications. Overall, current practices show progress in integration but face limitations in adaptability and scalability.

Practically speaking, overreliance on standardized questionnaires may overlook the needs of specific populations and contextual variations. This limits external validity. Future studies should focus on several levels of improvement. At the theoretical level, develop context-sensitive instruments more closely aligned with UX constructs. At the methodological level, deepen the integration of mixed methods by combining large-scale behavioral data with qualitative analysis. At the applied level, expand the use of experimental approaches among special populations. This includes exploring how feasibility trials and hybrid designs can balance scientific rigor with practical feasibility.

Taken together, this review highlights both the progress and limitations of UX research in mHealth applications. Future studies should consider employing more flexible theoretical models, such as Hassenzahl’s Model and CUE-Model, while integrating UX constructs with acceptance frameworks tailored to the specific characteristics of mHealth. Moreover, developing context-sensitive and personalized evaluation instruments is crucial for capturing the multidimensional nature of UX, thereby enhancing both theoretical rigor and practical relevance. This synthesis links the three core aspects, namely models, constructs, and methods. It demonstrates the interdependence of theoretical grounding, construct comprehensiveness, and methodological sophistication in advancing UX research.

5.2. Limitations

This review systematically synthesized UX research in mHealth, yet several limitations should be acknowledged. First, restricting the inclusion to English-language peer-reviewed articles may have introduced language and publication bias, thereby excluding grey literature and studies conducted in other contexts. Second, the review did not differentiate findings across application types or user populations, which may have masked important contextual variations. Nevertheless, despite these limitations, this study provides a rigorous and timely foundation for advancing UX research in mHealth.

6. Conclusion

This SLR demonstrates the growing recognition of UX as a key determinant of mHealth adoption and effectiveness. While progress has been made, persistent gaps remain in linking theoretical frameworks with standardized and context-sensitive evaluation tools. By identifying these gaps and synthesizing current practices, this study contributes to advancing both scholarly understanding and practical design guidance.

Specifically, the UX constructs identified in this review provide valuable guidance for future scholars in selecting appropriate theoretical models. The constructs related to mHealth applications further support cross-theoretical research. The methodological analysis offers a useful reference for selecting appropriate research approaches. This study also systematically reviews research methods applied in mHealth UX studies. However, it does not provide a detailed classification by age group, population characteristics, or application type.

Future research could address these gaps through more fine-grained classifications. Priority should be given to age groups and user population characteristics, as well as mHealth application types such as chronic versus acute care and AI (Artificial Intelligence)-based mHealth applications. These are expected to have a significant impact on UX outcomes. In addition, the development of robust and adaptable UX assessment approaches should be prioritized. Their validation across diverse contexts is also necessary to ensure more effective, inclusive, and sustainable mHealth solutions.

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Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this paper

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