Review

Applications and Current Landscape of Digital Health Technologies in the Continuity of Care for Liver Transplant Candidates and Recipients: Scoping Review

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Abstract

Background: Liver transplant candidates and recipients require continuous care throughout the transplant trajectory, including pretransplant prehabilitation and long-term posttransplant management. Conventional care models are constrained by time, distance, and limited health care resources and may therefore be insufficient to meet patients' needs across the continuum of care. Digital health technologies offer new approaches to remote care delivery and self-management support in liver transplantation.

Objective: This scoping review aimed to map the technological modalities, intervention components, outcome measures, and implementation issues associated with digital health technologies used across the care continuum for adult liver transplant candidates and recipients and to identify gaps for future digital continuity-of-care research.

Methods: Nine English- and Chinese-language databases—PubMed, Embase, CINAHL, Web of Science, the Cochrane CENTRAL, CNKI, Wanfang Data, VIP Database, and SinoMed—were searched from inception through July 10, 2026. Original quantitative, qualitative, and mixed methods studies involving adult liver transplant candidates or recipients and the use of digital health technologies for care beyond conventional in-person settings were eligible. The review followed the Arksey and O'Malley framework, was refined using the Joanna Briggs Institute methodology for scoping reviews, and was reported in accordance with the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines.

Results: The search identified 7746 records, and 28 studies were included. Telehealth platforms or remote management systems were used in 24 studies, and remote education was included in 22 studies. From the 28 studies, 5 focused on pretransplant/candidacy, 9 focused on early posttransplant recovery, 4 focused on long-term survivorship, 8 were cross-stage/mixed, and 2 had unspecified posttransplant timing. No study focused only on the perioperative/inpatient-to-home transition stage. A total of 9 randomized intervention studies were identified. Among these studies, positive findings were more common for medication or treatment adherence, self-management, health behaviors, psychological outcomes, and selected health service outcomes. Results were less consistent for quality of life, physiological outcomes, and functional outcomes. From the 28 studies, 15 reported implementation-related outcomes. Reported barriers included limited device access, privacy concerns, limited uptake, and difficulties with sustained engagement.

Conclusions: Current evidence is concentrated in early posttransplant recovery. Evidence across transplant stages and outcome domains is uneven. Studies focused on the perioperative/inpatient-to-home transition stage are lacking. Future studies should use multicenter designs and standardized outcome measures; include longer follow-up; and evaluate implementation, equitable access, and costs.

JMIR Mhealth Uhealth 2026;14:e106470; doi: 10.2196/106470

Keywords: digital health; mobile health; mHealth; eHealth; telemedicine; liver transplantation; mobile apps; continuity of patient care; scoping review; Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PRISMA

Introduction

Background

Liver transplantation (LT) is a definitive treatment for a range of end-stage liver diseases [1,2]. Advances in surgical techniques, perioperative management, and immunosuppressive therapy have substantially improved posttransplant survival [3]. A 50-year dataset from the European Liver Transplant Registry, covering 169 centers in 32 countries, showed overall survival rates of 83% at 1 year and 61% at 10 years after LT [4]. Despite its lifesaving potential, LT entails lifelong immunosuppressive therapy and persistent risks of acute rejection and multisystem complications [5,6]. Many recipients also face substantial financial burdens, barriers to resuming social roles, and other psychosocial and practical challenges [7]. Long-term health management across the posttransplant trajectory is therefore essential. Continuity-of-care interventions may strengthen self-management, support rehabilitation and social reintegration, and improve quality of life (QoL) among liver transplant recipients [8].

Continuity-of-care extends professional health care services from the hospital to patients' homes and communities, enabling patients to receive coordinated and ongoing support after discharge and helping to address their out-of-hospital care needs [9,10]. Evidence suggests that high-quality continuity-of-care interventions can improve self-management and, ultimately, health outcomes and QoL [11]. In LT, the care continuum spans the pretransplant waiting period, the early posttransplant transition, out-of-hospital rehabilitation, and lifelong follow-up [12]. Liver transplant candidates may experience advanced disease, complications, and psychological distress, requiring continued monitoring and support [13,14]. After transplantation, recipients remain at risk of rejection and other short-term and long-term complications and require continued follow-up and self-management support [15]. Including both candidates and recipients allows digital health applications to be examined across the full transplant trajectory. Current continuity-of-care models for liver transplant candidates and recipients continue to rely primarily on outpatient follow-up, supplemented by telephone follow-up and home visits [6]. These approaches are constrained by high outpatient workloads, geographic and temporal barriers, incomplete follow-up information, and substantial time and financial costs [16].

Digital health technologies, including telehealth, mobile apps, wearable devices, and remote monitoring systems, provide new ways to deliver care outside conventional clinical settings [17-19]. In transplantation, these technologies can support remote monitoring, follow-up, education, and communication between patients and health care professionals [20]. Evidence from solid organ transplantation suggests that digital health may support medication adherence, self-management, and selected clinical outcomes [21]. A recent scoping review by Gao et al [22] summarized the modalities, intervention components, and outcomes of telehealth used in home-based care for adult liver transplant recipients, providing an initial evidence base for the use of digital technologies in this field.

Despite growing evidence of the potential value of mobile health (mHealth) in the continuity of care for LT, existing research has focused predominantly on posttransplant recipients and has largely consisted of single-center studies with small samples. The literature is further characterized by limited use of theoretical frameworks, fragmented technological approaches, substantial heterogeneity in intervention components, and insufficient coverage of the full transplant trajectory.

Objectives

This scoping review aimed to map the current use of digital health technologies in continuity of care across the liver transplant trajectory. Specifically, we sought to (1) identify the principal technological modalities, intervention components, and outcome measures reported for pretransplant candidates and posttransplant recipients; (2) examine the advantages, implementation limitations, and appropriate care contexts of different digital health approaches; and (3) identify gaps in theoretical grounding, intervention design, outcome evaluation, and clinical translation to inform the development of specialty-specific digital continuity-of-care models for LT.

Methods

Study Design

This scoping review systematically mapped and synthesized evidence on the use of digital health technologies to support continuity of care across the liver transplant trajectory. The review was conducted according to the framework developed by Arksey and O'Malley [23], informed by updated methodological guidance from the Joanna Briggs Institute (JBI) [24], and reported in accordance with the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guideline (Checklist 1) [25]. A review protocol was not prospectively registered.

Search Strategy

An initial PubMed search was used to identify relevant terms and refine the search strategy. Reference lists of relevant studies were also hand searched. A total of 9 electronic databases were searched from inception through July 10, 2026: PubMed, Embase, CINAHL, Web of Science, Cochrane CENTRAL, CNKI, Wanfang Data, VIP Database, and SinoMed. Search concepts were developed

using the PCC (population, concept, and context) framework. MeSH and free-text terms were combined using Boolean operators, truncation, and wildcard symbols. The complete database-specific search strategies are provided in Multimedia Appendix 1.

Inclusion and Exclusion Criteria

The inclusion criteria were developed according to the PCC framework recommended by the JBI as follows:

- Population: studies involving liver transplant candidates or recipients aged 18 years or older were included.
- Concept: original empirical studies evaluating the application of digital health technologies in continuity of care for LT were included. Relevant technologies included mobile apps, telehealth or web-based platforms, internet-based communication technologies, remote monitoring or wearable devices, intelligent robots, and other digital technologies used to support continuity of care. These technologies were used for education, monitoring, consultation, self-management, rehabilitation, or psychosocial support.
- Context: studies conducted across the liver transplant care continuum in clinical, home, community, or virtual settings were eligible. Care could be delivered remotely or through hybrid online and face-to-face models and could occur before or after transplantation. Eligible contexts included pretransplant care, hospital-to-home transition, postoperative recovery, and long-term follow-up.

Original empirical studies using quantitative, qualitative, or mixed methods were included. Eligible study designs included randomized controlled trials (RCTs), nonrandomized intervention studies, observational studies, feasibility studies, pilot studies, technology development and user evaluation studies, and qualitative studies.

We excluded studies that (1) were reviews, study protocols, case reports, conference abstracts, editorials, commentaries, or letters; (2) involved only liver transplant recipients younger than 18 years or did not allow separate extraction of data for adult participants; (3) involved multiple organ transplant populations and did not allow separate extraction of liver transplant–specific data; (4) used digital technologies solely for research data collection rather than for the provision of patient care, health management, or continuity of care; (5) used digital technologies only for medical imaging, disease diagnosis, surgical navigation, organ allocation, risk prediction, or other technological applications unrelated to continuity of care in LT; or (6) were duplicate publications.

Study Selection

After duplicate records were removed using EndNote 2025 (Clarivate), 2 reviewers (SWQ and LYY) independently screened titles and abstracts and subsequently assessed the full texts against the eligibility criteria. A third reviewer (LJH) verified the search strategy and the final inclusion and exclusion decisions. Disagreements were resolved through discussion among the 3 reviewers.

Data Analysis and Synthesis

Two reviewers (SWQ and LRY) independently extracted and cross-checked study-level data using a standardized Microsoft Excel worksheet developed by the review team. Extracted data included study characteristics, participants, transplant timing, intervention and comparator characteristics, digital technologies, intervention content, outcomes, study findings, and implementation-related information. Two additional reviewers (LJH and CZJ) checked the extracted data for completeness and consistency. Disagreements were resolved by discussion, with SJ acting as an adjudicator when required.

The analytical categories for technology modalities, intervention components, outcome domains, and transplant trajectory stages were not prespecified. Consistent with JBI guidance, they were developed iteratively after review of all included studies and relevant literature [24,26]. Recurring characteristics were grouped into conceptually similar categories through team discussion. Technology modalities were classified by digital delivery medium, intervention components by clinical or supportive function, and outcomes by the constructs measured. Multiple coding was allowed because studies could include more than one technology, component, or outcome.

For stage-specific mapping, an additional coding framework was developed to locate each intervention along the liver transplant trajectory. Stage assignment was based primarily on participants' transplant status at the initiation of the intervention and the intended context in which the intervention was delivered, rather than on the final follow-up time point. The pretransplant/candidacy stage included transplant evaluation, wait-list management, decision support, and prehabilitation before LT. The perioperative/inpatient-to-home transition stage encompassed interventions actively delivered during the index transplant hospitalization, postoperative inpatient recovery, discharge planning, and transition to home. Technology onboarding or training performed immediately before discharge was not, by itself, considered a perioperative intervention when the substantive digital care began after discharge. Early posttransplant recovery was operationally defined as interventions initiated after discharge and targeting care within the first posttransplant year. Long-term posttransplant survivorship was defined as interventions initiated at or beyond 1 year after LT or interventions clearly targeting stable long-term recipients whose reported posttransplant timing was consistent with a survivorship context. The 1-year threshold was used as an analytical anchor rather than a biological cutoff and was informed by posttransplant survivorship literature [27,28]. The perioperative/inpatient-to-home transition stage was defined by clinical events rather than a fixed postoperative interval [29,30]. Studies in which the intervention or study population spanned more than one stage and stage-specific findings could not be separated were classified as cross-stage/mixed. If a study involved posttransplant recipients but did not report sufficient information to

determine intervention timing, the stage was coded as not specified rather than inferred.

No formal critical appraisal or risk-of-bias assessment was performed. Evidence from different study designs was synthesized descriptively and interpreted according to the study design. The findings were not used to establish evidence certainty or rank intervention effectiveness.

Ethical Considerations

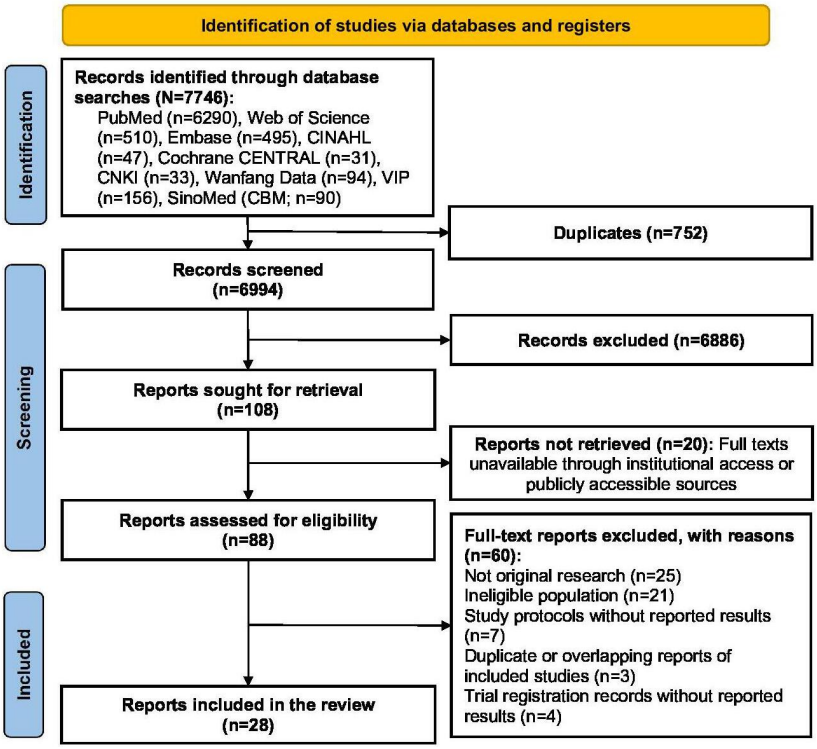
Ethical approval was not required because this scoping review used data from published studies and did not involve the collection of primary data from human participants.

Results

Study Selection

The database searches identified 7746 records. All records were imported into EndNote 2025, and 752 (9.71%) duplicates were removed, leaving 6994 records for title and abstract screening. Two reviewers (SWQ and LYY) independently screened these records against the eligibility criteria, and 6886 (98.46%) records were excluded. Of the 108 reports sought for retrieval, 20 full-text reports could not be obtained through the institutional or publicly accessible sources available at the time of screening, leaving 88 reports for full-text eligibility assessment. Of these, 60 were excluded because they were not original research (n=25), involved an ineligible population (n=21), were study protocols without reported results (n=7), were duplicate or overlapping reports of included studies (n=3), or were trial registration records without reported results (n=4). A total of 28 studies were included in the review. Figure 1 presents the PRISMA-ScR flow diagram.

Figure 1. PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) flow diagram.



Study Characteristics

The extracted data were synthesized to characterize the included studies by author, publication year, country, study design, sample size, participant age, comparator, intervention technology, and reported outcomes. Because of substantial heterogeneity in study designs and outcome reporting, a meta-analysis was not appropriate; findings were therefore synthesized narratively and summarized in tables.

The characteristics of the 28 included studies are summarized in Table 1. The 28 included studies were published between 2012 and 2026, with 16 (57.1%) published in 2021 or later. The studies were conducted in seven countries. The United States and China contributed the largest number of studies (n=11 each, 39.3%), followed by Australia (n=2, 7.1%). Austria, Belgium, Brazil, and Turkey each contributed 1 (3.6%) study.

Table 1. General characteristics of the included studies (N=28).

Study/year/country	Study design	Transplant trajectory stage	Population	Duration	Sample size	Age
Knihs et al [31], 2024, Brazil	Technological product development and validation study	Posttransplant timing unspecified	Patients who underwent LT[a], nurses, and IT professionals	Not applicable	28 participants (17 patients, 7 nurses, and 4 IT professionals)	Patients: 16-76 years; professionals: 23-47 years
Hickman et al [32], 2019, Australia	Qualitative study	Long-term survivorship	Adult LT recipients ≥12 months posttransplant	Not applicable	28	Mean 53 (SD 13; range 24-68) years
Goswami et al [33], 2024, United States	Pilot study	Cross-stage/mixed	LT candidates and recipients with ALD[b]/AUD[c]	12 weeks	42 (23 pretransplant/evaluation; 19 posttransplant)	Median 49 (IQR 39-63) years
Andrä et al [34], 2022, Austria	Single-center cohort study	Cross-stage/mixed	Liver transplant recipients enrolled in an outpatient aftercare program	2 months	124 (42 app users; 82 nonusers)	Entire cohort: 63.2 (range 19-76) years; app users: 55.4 years
Delman et al [35], 2021, United States	Retrospective cohort study	Cross-stage/mixed	Adult OLT[d] recipients	6-month follow-up	344 (274 pre–COVID-19; 70 COVID-19 era)	Pre–COVID-19: mean 53.2 (SD 17.1) years; COVID-19 era: mean 56.2 (SD 10.9) years
Lee et al [36], 2019, United States	Randomized controlled trial	Early posttransplant	Adult liver transplant recipients aged 18 years or older	90-day intervention; follow-up to 180 days	106 randomized; 100 completed and analyzed (50 intervention; 50 control)	Intervention: median 58.5 (IQR 51-65) years; control: median 60 (IQR 56-65) years
Tian et al [37], 2021, China	Cohort study	Early posttransplant	Adult OLT recipients	2-week intervention; 12-month follow-up	110 enrolled; 102 analyzed (52 telemedicine; 50 usual care)	Overall: mean 46.65 (SD 9.66) years; telemedicine: mean 45.35 (SD 10.44) years; usual care: mean 48.00 (SD 8.68) years
Koc et al [38], 2022, Belgium	Prospective cohort study	Long-term survivorship	Stable adult liver transplant recipients at least 12 months posttransplantation	Median follow-up approximately 2 years	115 (87 remote monitoring; 28 standard follow-up)	Median: autonomous remote monitoring 59.1 years; nonautonomous remote monitoring 67.2; standard follow-up 66.0
Volk et al [39], 2014, United States	Pilot pre-post study	Pretransplant/candidacy	Adult liver transplant candidates	Mean completion time 15 (range 7-28) minutes	56 enrolled; 53 completed	Median 56 (range 20-67) years
Bailey et al [40], 2017, United States	Randomized controlled trial	Pretransplant/candidacy	Adult patients awaiting LT and caregivers	8-week intervention; follow-up to 12 weeks	115 (56 SMI[e]; 59 LDE[f])	Self-management intervention: mean 56.4 (SD 9.9) years; education: mean 55.6 (SD 10.0) years
Konjeti et al [41], 2019, United States	Retrospective cohort study	Pretransplant/candidacy	Adult veterans referred for OLT evaluation	Not applicable	190 (91 telehealth evaluation; 99 direct referral)	Telehealth: 60.1 years; direct referral: 60.0 years
Hickman et al [42], 2021, Australia	Randomized feasibility study	Long-term survivorship	LT recipients ≥6 months posttransplant	12 weeks	35 (23 intervention; 12 delayed-intervention control)	Intervention: 50±15 years; control: 51±15 years
Dolanbay et al [43], 2025, Turkey	Randomized controlled trial	Cross-stage/mixed	Adult LT recipients 2 months–2 years posttransplant	1 month	90 (45 intervention; 45 control)	Intervention: mean 43.64 (SD 13.51) years; control: mean 53.24 (SD 10.52) years

Study/year/country	Study design	Transplant trajectory stage	Population	Duration	Sample size	Age
Ertel et al [44], 2016, United States	Nonrandomized observational pilot study	Early posttransplant	Consecutive adult liver transplant recipients discharged home	90 days	20	Mean 56 (SD 7; range 42-70) years
Duarte-Rojo et al [45], 2023, United States	Single-arm pilot and feasibility trial	Pretransplant/candidacy	Adult liver transplant candidates with cirrhosis, aged 40-70 years	14 weeks (2-week run-in plus 12-week intervention)	31 consented; 21 started the intervention; 15 completed final assessment	Consented cohort: mean 61 (SD 7) years; intervention cohort: mean 60 (SD 7) years
DeMartini et al [46], 2018, United States	Randomized pilot feasibility trial	Pretransplant/candidacy	Prelisting LT candidates with alcohol-related liver disease	8 weeks	15 randomized (8 intervention; 7 control); 14 analyzed	Overall: mean 50.80 (SD 7.86) years; intervention: mean 49.88 (SD 6.71) years; control: mean 51.86 (SD 9.44) years
Wang et al [47], 2023, United States	Cross-sectional model-development and internal-validation study	Cross-stage/mixed	Adults with cirrhosis in LT setting, listed or history of LT	Not applicable	145	Median 60 years; frail: median 61 (IQR 56-67); nonfrail: median 60 (IQR 52-65)
Catalli et al [48], 2026, United States	Single-arm quasi-experimental pre-post study	Long-term survivorship	Adults with MASLD[g]/cirrhosis; includes post-LT subgroup	12 weeks (six 90-minute sessions every 2 weeks)	70 (45 nontransplant; 25 post–liver transplant)	Overall: median 57 (IQR 46-66) years; posttransplant subgroup: median 60 (IQR 50-65) years
Lu et al [49], 2023, China	Randomized controlled study	Cross-stage/mixed	Adult patients after LT	3 months	46 (23 intervention; 23 control)	Intervention: mean 49.1 (SD 3.7; range 41-55) years; control: mean 49.3 (SD 3.2; range 40-56) years
Wang et al [50], 2012, China	Single-group pre-post implementation study	Posttransplant timing unspecified	Liver transplant recipients using an internet information platform for follow-up management	8 months	340	Not reported
Li et al [51], 2024, China	Technological system-development and preliminary application study	Cross-stage/mixed	Organ transplant recipients of all types, including liver transplant recipients	March 2019-May 2024	1730 total, including 488 LT	Not reported; 1648 adults and 82 minors
Liu et al [52], 2019, China	Quasi-experimental controlled study	Cross-stage/mixed	Adult first-time liver transplant recipients at least 6 months after LT	6-week intervention; follow-up at 3, 6, and 12 months	63 (32 intervention; 31 control)	Not reported
Zhai et al [53], 2021, China	Randomized controlled trial	Early posttransplant	Patients after LT	6 months	58 (29 intervention; 29 control)	Intervention: mean 47.31 (SD 9.24; range 26-66) years; control: mean 46.97 (SD 0.40; range 25-67) years
Pan et al [54], 2023, China	Randomized controlled study	Early posttransplant	Patients after LT	1 month	80 (45 intervention; 35 control)	Intervention: mean 49.38 (SD 4.86; range 35-63) years; control: mean 49.12 (SD 5.02; range 36-62) years

Study/year/country	Study design	Transplant trajectory stage	Population	Duration	Sample size	Age
Sun et al [55], 2019, China	Single-group pre-post study	Early posttransplant	Patients discharged after LT	3 months	60	Not reported
Tian et al [56], 2019, China	Prospective nonrandomized controlled cohort study	Early posttransplant	Recipients of DCD[h] liver transplants	3 months	100 (50 telemedicine robot; 50 telephone follow-up)	Telemedicine robot: mean 39 (SD 5) years; telephone follow-up: mean 38 (SD 6) years
Wang et al [57], 2023, China	Randomized controlled trial	Early posttransplant	Adult first-time liver transplant recipients after surgery	6 months	92 (46 intervention; 46 control)	Overall: mean 49.88 (SD 12.95; range 37-65) years; intervention: mean 49.95 (SD 13.64) years; control: mean 49.31 (SD 13.05) years
Xue et al [58], 2019, China	Single-arm feasibility study	Early posttransplant	Liver transplant recipients scheduled for outpatient follow-up after discharge	2 weeks	30 enrolled; 26 completed	22-67 years

[a]LT: liver transplantation.
[b]ALD: alcohol-related liver disease.
[c]AUD: alcohol use disorder.
[d]OLT: orthotopic liver transplantation.
[e]SMI: self-management intervention.
[f]LDE: liver disease education.
[g]MASLD: metabolic dysfunction-associated steatotic liver disease.
[h]DCD: donation after cardiac death.

A wide range of study designs was represented, including 7 (25.0%) RCTs, 2 (7.1%) randomized feasibility/pilot feasibility trials, 6 (21.4%) cohort studies, 4 (14.3%) quasi-experimental or single-group pre-post studies, 3 (10.7%) pilot studies, 2 (7.1%) single-arm feasibility studies, 2 (7.1%) technology development and preliminary application or validation studies, 1 (3.6%) cross-sectional model development and internal validation study, and 1 (3.6%) qualitative study.

With respect to the comparative structure, 17 (60.7%) studies included a distinct comparator group, such as a randomized concurrent control group, a nonrandomized concurrent comparator group, or a historical comparator group. An additional 5 (17.9%) studies used a single-group pre-post design. The remaining 6 (21.4%) studies included neither an external comparator group nor a formal pre-post comparison and primarily focused on technology development and validation, qualitative exploration, cross-sectional model development, or single-arm feasibility and implementation assessment.

According to the transplant trajectory classification, 5 studies focused on the pretransplant/candidacy stage [39-41,45,46], 9 on early posttransplant recovery [36,37,44,53-58], 4 on long-term survivorship [32,38,42,48], 8 were classified as cross-stage/mixed [33-35,43,47,49,51,52], and 2 involved posttransplant recipients for whom intervention timing was not specified [31,50]. No study focused exclusively on the perioperative/inpatient-to-home transition stage.

Modalities and Application Contexts of Digital Health Technologies for Liver Transplant Candidates and Recipients

Among the included studies, 5 principal digital health technology modalities were identified: mHealth apps (n=8), telehealth platforms or remote management systems (n=24), intelligent robots (n=3), portable wearable or mobile devices (n=4), and internet-based communication technologies (n=20). These categories were not mutually exclusive because individual interventions could use more than one modality. Telehealth platforms or remote management systems were the most frequently reported modalities. The identified technologies were used mainly for communication, monitoring, education, follow-up, rehabilitation, and self-management support (Table 2). One qualitative study [32] did not directly implement a digital health intervention and was excluded from the modality counts; it was retained as complementary evidence on user needs and implementation context.

Table 2. Digital health technology modalities and core functions.

Technology modality	Number of studies, n	Forms	Core functions
Mobile health apps	8 [31,34,36,37,45,51,54,56]	Smartphone-based or tablet-based applications, including dedicated apps and WeChat-based apps	Education, medication management, diet and exercise guidance, health monitoring; rehabilitation, and self-management support
Telehealth platforms or remote management systems	24 [33-39,41-45,47-58]	Web-based or platform-based systems integrating video visits, communication, monitoring, assessment, and feedback	Communication, remote monitoring, alerts, clinical decision support, education, follow-up, and multidisciplinary support
Intelligent robots	3 [37,56,58]	Telemedicine or remote monitoring robots	Physiological data collection, video communication, individualized guidance, and abnormality feedback
Portable wearable or mobile devices	4 [36,42,44,45]	Smartwatches, activity trackers, Bluetooth-enabled monitoring devices, and home-based exercise devices	Physiological and activity monitoring, data transmission, reminders, goal setting, and remote feedback and rehabilitation
Internet-based communication technologies	20 [33,35-37,40-42,45,46,48-58]	Videoconferencing, web portals, WeChat, text messaging, and telephone calls	Consultation, education, test-result feedback, medication support, rehabilitation and lifestyle guidance, and psychosocial support

Core Intervention Components of Digital Health Technologies for Liver Transplant Candidates and Recipients

Five major intervention components were identified: remote education (n=22), remote data monitoring or health assessment (n=16), teleconsultation (n=14), psychosocial support (n=10), and remote rehabilitation or exercise guidance (n=8). These categories were not mutually exclusive, and their distribution varied across the transplant trajectory (Table 3). Early posttransplant recovery contained the broadest combination of components: all 9 studies included remote education, and 8 each included monitoring or health assessment and teleconsultation [36,37,44,53-58]. Pretransplant/candidacy interventions focused on education and decision support, psychosocial support, prehabilitation, and remote transplant assessment [39-41,45,46]. Long-term intervention studies emphasized remote monitoring, lifestyle management, and rehabilitation [38,42,48], whereas cross-stage/mixed studies used combinations of education, monitoring, teleconsultation, and psychosocial support [33-35,43,47,49,51,52]. No study focused exclusively on the perioperative/inpatient-to-home transition stage.

Table 3. Intervention components across the liver transplant trajectory.

Main intervention components	Number of studies, n	Main functions/content	Transplant trajectory distribution
Remote education	22 [31,33-37,39,40,42-46,48,49,52-58]	Transplant/disease education, medication use, diet and nutrition, complication prevention, self-monitoring, lifestyle management, decision support, relapse prevention, and peer/family education	• Early posttransplant: n=9 [36,37,44,53-58] • Cross-stage/mixed: n=6 [33-35,43,49,52] • Pretransplant/candidacy: n=4 [39,40,45,46] • Long-term survivorship: n=2 [42,48] • Posttransplant timing unspecified: n=1 [31]
Remote data monitoring or health assessment	16 [34,36-38,42,44,45,47,49-51,53,54,56-58]	Vital signs, glucose and weight, physical activity, laboratory/imaging results, immunosuppressant levels, liver function, frailty, and longitudinal health records	• Early posttransplant: n=8 [36,37,44,53,54,56-58] • Cross-stage/mixed: n=4 [34,47,49,51] • Long-term survivorship: n=2 [38,42] • Pretransplant/candidacy: n=1 [45] • Posttransplant timing unspecified: n=1 [50]
Teleconsultation	14 [35-38,41,49-51,53-58]	Remote assessment and follow-up, triage, test-result feedback, medication adjustment, and individualized clinical guidance	• Early posttransplant: n=8 [36,37,53-58] • Cross-stage/mixed: n=3 [35,49,51] • Pretransplant/candidacy: n=1 [41] • Long-term survivorship: n=1 [38] • Posttransplant timing unspecified: n=1 [50]
Psychosocial support	10 [33,40,46,48,49,52-54,57,58]	Illness uncertainty, emotional support, relapse prevention, coping and	• Early posttransplant: n=4 [53,54,57,58]

Main intervention components	Number of studies, n	Main functions/content	Transplant trajectory distribution
		behavior change, and peer/family support	• Cross-stage/mixed: n=3 [33,49,52] • Pretransplant/candidacy: n=2 [40,46] • Long-term survivorship: n=1 [48]
Remote rehabilitation/ exercise guidance	8 [37,42,45,48,49,54,56,57]	Exercise and prehabilitation, lifestyle/ weight management, rehabilitation follow-up, individualized activity goals, and family-supported rehabilitation	• Early posttransplant: n=4 [37,54,56, 57] • Long-term survivorship: n=2 [42,48] • Pretransplant/candidacy: n=1 [45] • Cross-stage/mixed: n=1 [49]

Outcome Measures and Effects of Digital Health Technologies

Across the 28 included studies, reported outcomes were mapped into 6 nonmutually exclusive domains: physiological or functional indicators, psychosocial outcomes, clinical and health service utilization outcomes, self-management-related outcomes, health-related QoL, and implementation-related outcomes or patient experience (Table 4). Self-management-related outcomes were most frequently assessed (17/28, 60.7%), followed by implementation-related outcomes or patient experience (15/28, 53.6%) and clinical or health service utilization outcomes (10/28, 35.7%). Physiological or functional indicators and health-related QoL were each reported in 7 (25.0%) studies, whereas psychosocial outcomes were reported in 5 (17.9%) studies. Because individual studies often assessed more than one outcome domain, studies could contribute to multiple categories.

Table 4. Outcome domains and their distribution across the liver transplant trajectory.

Outcome domain	Number of studies, n	Main measures/outcomes	Transplant trajectory distribution	Design representation
Physiological/functional indicators	7 [38,42,44,45,47,48,54]	Tacrolimus concentration, serum creatinine, vital-sign thresholds, body weight/BMI, fasting and postprandial glucose, Liver Frailty Index, 6-minute walk test, physical activity, and metabolic indicators	• Long-term survivorship: 3 • Early posttransplant: 2; Pretransplant/ candidacy: 1 • Cross-stage/mixed: 1	• Randomized: 2 • Nonrandomized: 5
Psychosocial outcomes	5 [40,46,48,53,54]	Illness uncertainty, depression, anxiety, perceived stress, alcohol craving, abstinence self-efficacy, hope, confidence in behavior change, and emotional self-efficacy	• Pretransplant/ candidacy: 2 • Early posttransplant: 2 • Long-term survivorship: 1	• Randomized: 4 • Nonrandomized: 1
Clinical and health service utilization outcomes	10 [33,35-38,41,44,46,50, 54]	Readmission, length of stay, hospitalization/follow-up costs, outpatient utilization, complications, adverse events, rejection, graft/patient survival, alcohol relapse, and transplant evaluation/triage	• Early posttransplant: 4 • Pretransplant/ candidacy: 2 • Cross-stage/mixed: 2 • Long-term survivorship: 1 • Posttransplant timing unspecified: 1	• Randomized: 3 • Nonrandomized: 7
Self-management-related outcomes	17 [34,36,39,40,42,43,45, 46,48-50,52-57]	Disease/medication knowledge, organ-quality decision knowledge, medication and follow-up adherence, treatment adherence, self-efficacy, self-care, self-management behavior, and behavior-change confidence	• Early posttransplant: 6 • Pretransplant/ candidacy: 4 • Cross-stage/mixed: 4 • Long-term survivorship: 2 • Posttransplant timing unspecified: 1	• Randomized: 9 • Nonrandomized: 8
Health-related quality of life	7 [36,40,42,49,52,53,55]	FACT-G[a], SF-12v2[b], SF-36[c], liver transplant-specific quality-of-life instruments,	• Early posttransplant: 3	• Randomized: 5 • Nonrandomized: 2

Outcome domain	Number of studies, n	Main measures/outcomes	Transplant trajectory distribution	Design representation
		multidimensional physical, psychological, and social domains	• Cross-stage/mixed: 2; Pretransplant/candidacy: 1 • Long-term survivorship: 1	
Implementation-related outcomes and patient experience	15 [31,33,34,36,38,39,42,44-46,48,50,51,56,58]	Participation, attendance, completion, system mastery and use, consultations/messages, satisfaction, acceptability, usability, accessibility, and privacy and digital-access concerns	• Early posttransplant: 4 • Pretransplant/candidacy: 3 • Long-term survivorship: 3 • Cross-stage/mixed: 3 • Posttransplant timing unspecified: 2	• Randomized: 3 • Nonrandomized: 12

[a]FACT-G: Functional Assessment of Cancer Therapy-General.
[b]SF-12v2: 12-Item Short Form Health Survey, Version 2.
[c]SF-36: 36-Item Short Form Health Survey.

The distribution of outcomes varied across the transplant trajectory. In the pretransplant/candidacy stage, the evidence focused primarily on decision-related knowledge, self-management, psychosocial adjustment, alcohol-related behavior, frailty, and physical fitness. Early posttransplant studies covered the broadest range of outcomes, particularly medication adherence, self-care and self-management, readmission and other health service outcomes, physiological monitoring, psychological adjustment, and QoL. Long-term survivorship studies more often assessed lifestyle behavior, cardiometabolic or functional outcomes, self-management, and implementation-related experience. Cross-stage/mixed studies contributed mainly to self-management, clinical/service utilization, QoL, and technology-supported follow-up outcomes. No included study focused exclusively on the perioperative/inpatient-to-home transition stage; this phase was represented only within broader cross-stage care models.

The strength and type of evidence also differed across outcome domains. Randomized studies accounted for 9 of the 17 studies assessing self-management-related outcomes and 5 of the 7 studies assessing health-related QoL. Psychosocial outcomes were also predominantly represented by randomized designs (4/5). In contrast, clinical and health service utilization outcomes (3/10, randomized), physiological or functional outcomes (2/7, randomized), and implementation-related outcomes or patient experience (3/15, randomized) were more frequently reported in nonrandomized, feasibility, pilot, cohort, or development-oriented studies. Accordingly, Table 4 is intended as an evidence map rather than an effectiveness summary. Detailed quantitative findings from randomized intervention studies are presented separately in the *Findings From Randomized Intervention Studies* section and Table 5, whereas quantitative findings from nonrandomized studies are summarized in the *Findings From Nonrandomized Studies* section and Table 6.

Table 5. Key findings from randomized intervention studies (n=9).

Study	Study design and transplant trajectory stage	Intervention and comparator	Main outcome(s)	Key quantitative and statistical findings
Lee et al [36], 2019	• Randomized controlled trial • Early posttransplant	Telemedicine-based home monitoring program vs standard care	Hospital readmission and HRQoL[a]	90-day readmission was lower with telemonitoring (28% vs 58%; *P*=.004). Physical functioning at 90 days also favored intervention (75 vs 60; *P*=.02), whereas most other SF-36[b] domains did not differ significantly
Bailey et al [40], 2017	• Randomized controlled trial • Pretransplant/candidacy	Telephone uncertainty self-management intervention vs liver-disease education	Illness uncertainty, depression, anxiety, uncertainty management, self-efficacy, and HRQoL	No significant between-group differences were found in illness uncertainty, depression, anxiety, self-efficacy, or FACT-G[c] QoL[d] at either follow-up (all *P*>.05)
Hickman et al [42], 2021	• Randomized feasibility study	Telehealth-delivered Mediterranean diet + exercise program vs delayed-intervention control	Dietary adherence, anthropometric/metabolic	MEDAS[e] change favored intervention (+2.4 vs –0.1; *P*=.004), as did MCS-12[f] (+2.8 vs –2.0;

Study	Study design and transplant trajectory stage	Intervention and comparator	Main outcome(s)	Key quantitative and statistical findings
	• Long-term survivorship		outcomes, functional status, and HRQoL	*P*=.03). Most anthropometric, biochemical, and functional outcomes did not differ significantly
Dolanbay et al [43], 2025	• Randomized controlled trial • Cross-stage/ mixed	Web-based education vs control	Immunosuppressive medication-related symptoms, symptom distress, and medication adherence	Symptom occurrence (90.96 vs 112.49; *P*=.009) and symptom distress (19.98 vs 53.51; *P*=.009) were lower, and medication adherence was higher (49.33 vs 46.18; *P*=.001) in the intervention group
DeMartini et al [46], 2018	• Randomized pilot feasibility trial • Pretransplant/ candidacy	Tailored text-messaging relapse-prevention intervention + standard care vs standard care	Alcohol use/relapse, stress, abstinence self-efficacy, craving, and feasibility	At 8 weeks, positive urine EtG[g] tests occurred in 0/8 intervention participants vs 2/6 controls; no formal between-group test was reported. Self-reported drinking did not differ (*P*=.19). Stress showed a condition × time interaction (*P*<.05), without significant between-group differences at weeks 4 or 8
Lu et al [49], 2023	• Randomized controlled study • Cross-stage/ mixed	Internet-enabled hospital-community-family continuity-of-care model vs conventional continuity care	Self-care, self-management, and HRQoL	At 3 months, self-care, self-management, and multiple LT[h]-specific QoL domains favored intervention (all reported *P*<.05); medication-management scores were 22.87 vs 17.29
Zhai et al [53], 2021	• Randomized controlled trial • Early posttransplant	Mobile health platform–based continuity of care vs routine care	Psychological outcomes; hope, adherence, self-care, self-management, HRQoL, and satisfaction	Medication adherence (12.14 vs 8.69; *P*<.001) and self-management (44.86 vs 34.45; *P*<.001) were higher, while anxiety and depression were lower. Total QoL also favored intervention, although not all QoL domains differed significantly
Pan et al [54], 2023	• Randomized controlled study • Early posttransplant	WeChat educational app + supervised family intervention vs routine care	Glycemic control, medication adherence, self-management, anxiety/ depression, and complications	Glycemic control, medication adherence, self-management, and psychological outcomes favored intervention (all *P*<.001). Postoperative complications were lower (2.22% vs 17.14%; *P*=.02)
Wang et al [57], 2023	• Randomized controlled trial • Early posttransplant	Remote rehabilitation management vs routine postoperative follow-up	Treatment adherence and self-care capacity	Treatment adherence (85.03 vs 64.58; *P*<.001) and self-care capacity (95.38 vs 72.23; *P*<.001) were higher with remote rehabilitation management

[a]HRQoL: health-related quality of life.
[b]SF-36: 36-Item Short Form Health Survey.
[c]FACT-G: Functional Assessment of Cancer Therapy-General.
[d]QoL: quality of life.
[e]MEDAS: Mediterranean Diet Adherence Screener.
[f]MCS-12: Mental Component Summary of the 12-Item Short Form Health Survey.
[g]EtG: ethyl glucuronide.
[h]LT: liver transplantation.

Table 6. Key findings from nonrandomized quantitative studies (n=18).

Study	Study design and transplant trajectory stage	Digital application/intervention	Key quantitative findings
Knihs et al [31], 2024	• Technology product development and validation • Posttransplant timing unspecified	Educational mobile game for home care	Patient SUS[a] mean=80; professional usability ratings were >75%. No clinical-effect comparison was performed
Goswami et al [33], 2024	• Pilot study • Cross-stage/mixed	Tailored virtual alcohol use disorder treatment program	76% (32/42) participants completed the program. Relapse occurred in 22% of completers vs 80% of noncompleters

Study	Study design and transplant trajectory stage	Digital application/intervention	Key quantitative findings
			(*P*=.002); this comparison was observational
Andrä et al [34], 2022	• Single-center cohort study • Cross-stage/mixed	Mobile app for outpatient LT[b] aftercare	91.9% (124/135) agreed to participate, 57.3% (71/124) had a compatible device, and 33.8% (42/124) used the app. Privacy concerns were reported by 59.5% of users
Delman et al [35], 2021	• Retrospective cohort study • Cross-stage/mixed	Telehealth-centered transplant service during COVID-19	Telehealth accounted for up to 85% of clinic visits. Hospital stay was shorter in the COVID-era cohort (8.5 vs 13.1 d; *P*=.02); patient and graft survival did not differ significantly
Tian et al [37], 2021	• Cohort study • Early posttransplant	Telemedicine follow-up management	Telemedicine was associated with shorter initial hospitalization (16.31 vs 19.12 days; *P*=.03), lower initial cost (*P*=.049), and lower 30-day readmission (*P*=.02); 12-month survival did not differ significantly
Koc et al [38], 2022	• Prospective cohort study • Long-term survivorship	Telemedicine remote monitoring program	Remote monitoring users had fewer outpatient visits (2 vs 5; *P*<.001) and more TAC[c] determinations (8 vs 6; *P*=.001), with no significant difference in graft rejection (2.6% vs 3.6%; *P*=.34)
Volk et al [39], 2014	• Pilot pre-post study • Pretransplant/candidacy	Web-based organ-quality decision aid	Knowledge, risk perception, and willingness to consider less-than-perfect donor organs improved after the intervention (all *P*<.001); decision confidence did not change significantly
Konjeti et al [41], 2019	• Retrospective cohort study • Pretransplant/candidacy	SCAN-ECHO[d] telehealth triage for LT evaluation	Rejection after full transplant work-up was lower with telehealth triage (23.1% vs 55.6%; *P*<.0001), suggesting fewer potentially futile evaluations
Ertel et al [44], 2016	• Nonrandomized observational pilot • Early posttransplant	Video education plus telehealth home monitoring	95% viewed all educational videos and mean satisfaction was 29/30. 30-day and 90-day readmission rates were 20% and 30%, respectively; no comparative statistical test was performed
Duarte-Rojo et al [45], 2023	• Single-arm pilot and feasibility trial • Pretransplant/candidacy	Wearable-supported and app-supported home prehabilitation with remote coaching	21/31 participants entered the intervention and training adherence was 57%. Among completers, LFI[e] improved (*P*=.03) and 6MWT[f] increased from 318 to 358 m (*P*=.005)
Wang et al [47], 2023	• Cross-sectional model development/internal validation • Cross-stage/mixed	TeLeFI[g]	TeLeFI models showed cross-validated *C*-statistics of 0.78 and 0.76; the model incorporating virtual chair stands improved frailty classification (NRI[h]=0.70; *P*=.002)
Catalli et al [48], 2026	• Single-arm quasi-experimental pre-post study • Long-term survivorship	Telehealth shared medical appointments	Several psychosocial and self-efficacy measures improved among post-LT participants (*P*=.001-.03), whereas BMI reduction was not significant (32.0 to 30.1 kg/m²; *P*=.06)
Wang et al [50], 2012	• Single-group pre-post implementation study • Posttransplant timing unspecified	Internet information platform for follow-up	Follow-up laboratory-result time decreased from 240 to 5 minutes, scheduled follow-up adherence increased from 82.3% to 95.6%, and adverse events decreased from 11.8% to 4.4%
Li et al [51], 2024	• Technology system development/preliminary application • Cross-stage/mixed	Whole-lifecycle digital health management system (SWOR[i])	The system was implemented in 1730 organ transplant recipients, including 488 LT recipients. No comparative LT-specific patient-effect estimate was reported
Liu et al [52], 2019	• Quasi-experimental controlled study • Cross-stage/mixed	WeChat-based peer education	Medication-adherence measures improved at selected follow-ups, but total adherence was not significantly different at 12

Study	Study design and transplant trajectory stage	Digital application/intervention	Key quantitative findings
			months (P=.07). Between-group QoL[j] differences were not significant
Sun et al [55], 2019	• Single-group pre-post study • Early posttransplant	WeChat-based multidisciplinary continuity care	Self-care (P=.002), transplant knowledge (P<.001), and medication-adherence distribution (P<.001) improved at 3 months compared with discharge
Tian et al [56], 2019	• Prospective nonrandomized controlled cohort • Early posttransplant	Telemedicine robot follow-up	Total adherence was higher with robot-based follow-up (84.0 vs 61.4; P<.001), with shorter follow-up time and higher satisfaction (both P<.001)
Xue et al [58], 2019	• Single-arm feasibility study • Early posttransplant	Remote follow-up management system	81.1% (30/37) eligible recipients participated, system mastery was 100%, and 86.7% (26/30) completed 2 weeks; satisfaction was generally >4/5

[a]SUS: System Usability Scale.
[b]LT: liver transplantation.
[c]TAC: tacrolimus.
[d]SCAN-ECHO: Specialty Care Access Network–Extension for Community Healthcare Outcomes.
[e]LFI: Liver Frailty Index.
[f]6MWT: 6-minute walk test.
[g]TeLeFI: Tele-Liver Frailty Index.
[h]NRI: net reclassification improvement.
[i]SWOR: system for the whole life-cycle management of organ transplant recipient.
[j]QoL: quality of life.

Findings From Randomized Intervention Studies

Among the included studies, 7 were conventional RCTs and 2 additional studies used randomized feasibility or pilot feasibility designs. This review separately examined these 9 randomized intervention studies to provide a more specific account of the reported intervention effects and statistical findings (Table 5). According to the transplant trajectory classification used in this review, 4 studies focused on early posttransplant recovery [36,53,54,57], 2 on the pretransplant/candidacy stage [40,46], 2 spanned multiple stages of posttransplant care [43,49], and 1 focused predominantly on long-term posttransplant survivorship [42]. No randomized study focused exclusively on the perioperative/inpatient-to-home transition stage.

Across randomized studies, favorable findings were more consistently reported for proximal outcomes, including medication or treatment adherence, self-management or self-care, dietary behavior, psychological outcomes, and selected health service outcomes. For example, telemedicine-based home monitoring reduced 90-day readmission (28% vs 58%; P=.004) [36], and a WeChat-based intervention reported fewer postoperative complications (2.22% vs 17.14%; P=.02), together with improvements in glycemic control, adherence, self-management, and psychological outcomes [54]. Findings for broader outcomes were less consistent. The long-term diet and exercise feasibility trial improved Mediterranean diet adherence and mental HRQoL but not most anthropometric, biochemical, or functional outcomes [42], whereas the 2 pretransplant randomized studies reported limited or inconsistent between-group effects [40,46].

Several interventions with favorable findings used repeated digital contact together with education, monitoring, professional feedback, rehabilitation guidance, or family support. However, the studies differed in population, transplant stage, intervention intensity, comparator, follow-up duration, and outcome measurement, and 2 were designed primarily to assess feasibility. The findings were therefore synthesized descriptively and were not used to infer the superiority of specific intervention modalities or components.

Findings From Nonrandomized Studies

Of the 19 nonrandomized studies, 18 reported extractable quantitative findings and are summarized in Table 6; the remaining study was a qualitative study of long-term liver transplant recipients [32] and therefore did not contribute quantitative effect estimates. The nonrandomized evidence encompassed cohort comparisons, quasi-experimental and single-group pre-post studies, pilot and feasibility studies, and technology-development or model-development studies. Because these designs differed substantially in their susceptibility to confounding, selection effects, and secular trends, the numerical findings are presented descriptively and are not interpreted as causal estimates of intervention effectiveness.

Pretransplant studies addressed decision support, transplant triage, and prehabilitation. A web-based decision aid improved several knowledge and risk-perception measures [39], telehealth triage reduced the proportion of patients completing a full evaluation before being judged ineligible [41], and home-based prehabilitation improved Liver Frailty Index and 6-minute walk distance among completers [45]. Early posttransplant studies focused mainly on monitoring and follow-up. Telemedicine follow-up was associated with shorter initial hospitalizations, lower costs,

and lower 30-day readmission rates without significant survival differences [37], while other studies reported improvements in adherence, self-care, follow-up efficiency, or short-term feasibility [50,55,56,58].

Among long-term and cross-stage populations, remote monitoring reduced outpatient visits while maintaining comparable graft-rejection outcomes [38], whereas lifestyle and peer-support interventions produced mixed behavioral, psychosocial, and QoL findings [33,48,52]. Several studies evaluated technology usability, implementation, or model performance rather than therapeutic effectiveness [31,47,51]. Overall, favorable findings frequently arose from single-arm comparisons, self-selected users, historical controls, or small pilot cohorts and should therefore be interpreted cautiously.

Implementation-Related Outcomes of Digital Health Technologies

Structured implementation-related outcomes or patient-experience measures were reported in 15 of the 28 included studies [31,33,34,36,38,39,42,44-46,48,50,51,56,58]. These outcomes primarily assessed participation and uptake, intervention completion, system mastery and frequency of use, satisfaction, acceptability, usability, accessibility, and user concerns related to digital technology. From the 15 studies, 3 used randomized designs [36,42,46], whereas the remaining 12 used nonrandomized cohort, pilot, single-arm feasibility, pre-post, or technology-development designs. Accordingly, these measures were interpreted as indicators of implementation feasibility and user experience rather than as evidence of clinical effectiveness.

Uptake and engagement varied across studies. In 1 outpatient app study, 91.9% of eligible recipients agreed to participate, but only 57.3% had a compatible device and 33.8% ultimately used the application; 59.5% of users reported privacy concerns [34]. Other studies reported generally favorable short-term completion, usability, or satisfaction [31,33,44,45,58]. The qualitative study [32] provided complementary evidence on recipients' preferences and perceived barriers. Implementation evaluations were distributed across early posttransplant recovery (n=4), pretransplant/candidacy (n=3), long-term survivorship (n=3), cross-stage/mixed care (n=3), and unspecified posttransplant timing (n=2); none focused exclusively on the perioperative/inpatient-to-home transition stage. Overall, willingness to participate, technological access, actual uptake, and sustained engagement emerged as related but distinct implementation dimensions.

Discussion

Principal Findings

This scoping review mapped digital health technologies across the liver transplant trajectory and identified substantial variation in technological modalities, intervention components, study designs, and outcomes. Telehealth platforms or remote management systems were the most frequently reported technological modalities, and remote education was the most common intervention component. Evidence was unevenly distributed across the transplant trajectory. Early posttransplant recovery was the most frequently studied stage, whereas no included study focused exclusively on the perioperative/inpatient-to-home transition stage. Compared with the previous scoping review of telehealth in home-based care for adult liver transplant recipients [22], the present review included both transplant candidates and recipients and examined intervention components, outcomes, study designs, and implementation evidence across different stages of the transplant trajectory.

Randomized studies more often reported favorable findings for outcomes closely related to the intervention, including medication or treatment adherence, self-management and self-care, dietary behavior, psychological outcomes, and selected health service outcomes [36,42,43,49,53,54,57]. Findings were less consistent for broader outcomes such as overall QoL, physiological or functional measures, and longer-term clinical outcomes [40,42,46]. This pattern may reflect differences in how directly these outcomes can be influenced by short-term digital interventions. Behavioral and self-management outcomes may respond more quickly to repeated education, reminders, monitoring, or feedback, whereas broader clinical and QoL outcomes are influenced by multiple clinical and psychosocial factors and may require longer follow-up.

Several randomized interventions with favorable findings combined repeated digital contact with education, monitoring, professional feedback, rehabilitation guidance, or family support [36,42,49,53,54,57]. These interventions generally extended beyond one-way information delivery and maintained communication between patients and health care professionals. However, this pattern should not be interpreted as evidence that multicomponent interventions are superior. The included randomized studies differed substantially in population, transplant stage, intervention intensity, comparator, follow-up duration, and outcome measurement, and this review did not compare the effects of individual intervention components. The observed pattern therefore identifies a potential direction for intervention design rather than a specific effective combination of components.

Stage-specific mapping showed that digital health was used to address different care needs across the transplant trajectory. Pretransplant interventions addressed decision support, psychological and behavioral support, transplant assessment, and prehabilitation [39-41,45,46], but the evidence remained limited and heterogeneous. Early posttransplant recovery had the broadest range of intervention components and the largest concentration of studies, with particular emphasis on education, monitoring, teleconsultation, medication management, rehabilitation, and follow-up [36,37,44,53-58]. In contrast, long-term survivorship studies focused more on remote monitoring, lifestyle and metabolic management, rehabilitation, and psychosocial support [32,38,42,48]. Cross-stage interventions addressed broader continuity-of-care needs through combinations of education, monitoring, consultation, peer support, and longitudinal management [33-35,43,47,49,51,52].

The absence of studies focused exclusively on the perioperative/inpatient-to-home transition represents an important evidence gap. Some cross-stage interventions included elements relevant to discharge and follow-up, but no intervention was designed and evaluated specifically for this transition period. This gap should not be interpreted as indicating a lower need for digital support; rather, it reflects the current distribution of research across the transplant trajectory.

Implementation findings further showed that initial willingness to participate should not be equated with successful implementation. Across studies, acceptability, technological access, actual uptake, and sustained engagement varied and represented distinct implementation dimensions [32,34]. High satisfaction or short-term completion therefore does not necessarily indicate that an intervention can be sustained or integrated into routine transplant care. Overall, the current evidence suggests that digital health may be most useful when incorporated into structured follow-up pathways that support communication, monitoring, education, self-management, and professional feedback. However, much of the evidence for physiological, health service, and implementation outcomes came from nonrandomized, pilot, feasibility, cohort, or technology-development studies. These findings should therefore be interpreted as evidence of potential clinical utility and implementation feasibility rather than definitive comparative effectiveness.

Strengths and Limitations

This review has 5 key strengths. First, the search covered 9 English-language and Chinese-language databases, capturing evidence from both international and Chinese settings, and included both liver transplant candidates and recipients across a range of clinical contexts including donor organ decision support [39], alcohol-related behavioral risk management [33,46], and long-term recipients' care preferences [32]. Second, qualitative evidence was included to complement quantitative findings on patient needs and implementation context. Third, evidence was organized by a transplant trajectory stage framework, clearly identifying evidence gaps such as the lack of perioperative transition studies. Fourth, randomized and nonrandomized evidence were synthesized separately to avoid conflating heterogeneous study designs, and implementation-related outcomes (uptake, usability, acceptability, and so on) were incorporated to support real-world clinical translation. Finally, the review followed established scoping review guidance (Arksey and O'Malley framework, JBI guidance, and PRISMA-ScR) to ensure transparency and reproducibility.

Several limitations should be considered when interpreting the findings. First, the scoping review protocol was not prospectively registered. Second, no formal critical appraisal or risk-of-bias assessment of included studies was performed, so findings should not be interpreted as establishing the certainty of evidence or comparative effectiveness of specific interventions. Third, 20 potentially relevant reports could not be retrieved in full text, which may have introduced selection bias and limited the comprehensiveness of the evidence base. Fourth, substantial heterogeneity in study designs, intervention characteristics, follow-up periods, and outcome measures precluded quantitative synthesis. Many included studies were small, single-center pilot/feasibility designs with limited longitudinal evidence [33,39,42,44-46,58], and their findings should be considered exploratory. These limitations indicate that the field remains at an early stage of development, requiring further evidence to establish the effectiveness of digital health interventions in liver transplant care.

Recommendations for Future Research and Development

Future research should strengthen the methodological rigor and comparability of digital health studies in LT. The current evidence includes relatively few randomized trials, while many studies were small, single-center, pilot, feasibility, cohort, or pre-post studies. Studies evaluating effectiveness should use multicenter comparative designs with justified sample sizes and longer follow-up. Greater consistency in outcome selection and measurement is also needed. Researchers should use validated measures where possible, prespecify primary and secondary outcomes, and report intervention content, delivery mode, intensity, duration, adherence, and attrition in sufficient detail. Reporting guidance such as CONSORT-EHEALTH (Consolidated Standards of Reporting Trials of Electronic and Mobile Health Applications and Online Telehealth) may improve transparency and facilitate future evidence synthesis [59].

Research priorities should also reflect the transplant trajectory. Pretransplant studies should further evaluate digital approaches for decision support, behavioral and psychological support, and prehabilitation. Early posttransplant research should examine whether improvements in adherence and self-management are sustained and translate into clinical or health service outcomes. Long-term studies should place greater emphasis on lifestyle management, functional recovery, cardiometabolic risk, psychosocial adjustment, and sustained engagement with follow-up care. The perioperative/inpatient-to-home transition requires particular attention because no included study focused exclusively on this stage. Future interventions could address discharge preparation, early symptom monitoring, medication management, and communication between patients and the transplant team.

Intervention development should also clarify which components contribute to meaningful and sustained outcomes. Several randomized interventions with favorable findings combined repeated digital contact with education, monitoring, professional feedback, rehabilitation guidance, or family support. However, the current evidence does not establish which individual components or combinations are responsible for these findings. Future studies should describe intervention components, delivery processes, professional contact, personalization, caregiver involvement, and intervention fidelity more consistently. Comparative or optimization designs may help examine the contribution of individual components and distinguish the effects of technology from the clinical support delivered through it.

Implementation should be treated as a core research outcome. Future studies should examine not only satisfaction or usability but also access, uptake, engagement, workflow integration, maintenance, and scalability. The effects of digital care on the workload of transplant nurses and other health care professionals should also be assessed, including how patient-generated data are reviewed and how responsibilities are distributed within multidisciplinary teams. User-centered design should remain central [60], and privacy and data security should be considered throughout intervention development and implementation [61].

Equity and economic sustainability require parallel evaluation. Digital interventions may improve access to specialist care but may also disadvantage patients with limited device access, internet connectivity, digital skills, health literacy, or confidence in using technology. Older adults may face additional usability and accessibility barriers, although age alone should not be treated as a proxy for inability to use digital care [62,63]. Future studies should assess digital access and literacy, include patients and caregivers from diverse socioeconomic and geographic backgrounds, and consider training, caregiver support, alternative access methods, and hybrid care models. Economic evaluations should include development, equipment, maintenance, staffing, training, data management, and patient-side costs and assess whether reductions in travel, outpatient visits, or unplanned service use offset implementation costs. Effectiveness, implementation, equity, and economic outcomes should be considered together when assessing the long-term role of digital health in routine liver transplant care.

Conclusions

This scoping review mapped digital health technologies across the liver transplant trajectory. Most studies focused on early posttransplant recovery. Randomized studies more often reported positive findings for adherence, self-management, health behaviors, and selected psychosocial or health service outcomes, while findings for QoL, physiological outcomes, functional outcomes, and long-term clinical outcomes were less consistent. No study focused exclusively on the perioperative/inpatient-to-home transition stage. Much of the current evidence came from nonrandomized, pilot, feasibility, or small single-center studies. Future studies should use stage-specific and multicenter designs, improve the consistency of intervention and outcome reporting, and assess long-term implementation, access, and costs.

Generative AI Use

No generative AI tools were used for manuscript preparation, writing, editing, or data-related analyses in this study.

Funding

This work was supported by the Scientific Research Project of the Education Department of Jilin Province (JJKH20250227KJ) and the Jilin Provincial Department of Finance (J1SRCZX2025-074). The funders had no role in the design or conduct of the review; literature searching; study selection; data extraction, analysis, or interpretation; preparation of the manuscript; or the decision to submit the manuscript for publication.

Authors' Contributions

Conceptualization: WS, JS
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Formal analysis: WS, RL, FY
Investigation: WS, JL, YL
Supervision: JS
Validation: JL, ZC
Visualization: WS, JL, YL
Writing – original draft: WS, RL
Writing – review & editing: JS, FY

Conflicts of Interest

None declared.

Multimedia Appendix 1

Complete database-specific search strategies for 5 international and 4 Chinese bibliographic databases, covering database inception through July 10, 2026.
[PDF File (Adobe File), 164 KB-Multimedia Appendix 1]

Checklist 1

PRISMA-ScR checklist.
[DOCX File (Microsoft Word File), 69 KB-Checklist 1]

References

1. Sugawara Y, Hibi T. Recent trends and new developments in liver transplantation. Biosci Trends. Jul 9, 2024;18(3):206-211. [doi: 10.5582/bst.2024.01176] [Medline: 38945855]

2. Department of Medical Administration, National Health Commission of the People's Republic of China. Guidelines for the diagnosis and treatment of primary liver cancer (2026 Edition) [Article in Chinese]. Med J Peking Union Med Coll Hosp. 2026;17(3):735-770. [doi: 10.12290/xhyxzz.2026-0487]
3. Bernal W, Bittermann T, Sheth R, et al. Survival with and without liver transplantation in critically ill patients with cirrhosis: a 20-year experience. Clin Gastroenterol Hepatol. Feb 2026;24(2):432-442. [doi: 10.1016/j.cgh.2025.04.029] [Medline: 40473089]
4. Adam R, Karam V, Cailliez V, et al. 2018 annual report of the European Liver Transplant Registry (ELTR) - 50-year evolution of liver transplantation. Transpl Int. Dec 2018;31(12):1293-1317. [doi: 10.1111/tri.13358] [Medline: 30259574]
5. Kaplan A, Korenjak M, Brown RS Jr. Post-liver transplantation patient experience. J Hepatol. Jun 2023;78(6):1234-1244. [doi: 10.1016/j.jhep.2023.01.008] [Medline: 37208108]
6. Shen S, Su G, Liang H. Long-term follow-up and complication management after curative treatment for liver cancer [Article in Chinese]. J Clin Intern Med. 2026;43(2):105-108. [doi: 10.3969/j.issn.1001-9057.2026.02.004]
7. Wang J, Zhou D, Zhou Y, et al. Patients waiting for a liver transplantation from the perspective of psychological resilience: a qualitative study [Article in Chinese]. Chin J Nurs. 2025;60(15):1864-1871. [doi: 10.3761/j.issn.0254-1769.2025.15.011]
8. Hoppmann N, Massoud O. Medical care of liver transplant patients. Expert Rev Gastroenterol Hepatol. Oct 2020;14(10):901-918. [doi: 10.1080/17474124.2020.1797483] [Medline: 32684007]
9. Xu J. Advances in research on continuity-of-care models in China [Article in Chinese]. Chin Nurs Manage. 2012;12(9):18-19. [doi: 10.3969/j.issn.1672-1756.2012.09.005]
10. Guo H, Sha L, Pu C, Cheng Y. Application of "internet+" to continuous nursing of patients after surgery: a literature review [Article in Chinese]. Chin Nurs Manage. 2019;19(7):1045-1049. [doi: 10.3969/j.issn.1672-1756.2019.07.018]
11. Davis KM, Eckert MC, Hutchinson A, et al. Effectiveness of nurse-led services for people with chronic disease in achieving an outcome of continuity of care at the primary-secondary healthcare interface: a quantitative systematic review. Int J Nurs Stud. Sep 2021;121:103986. [doi: 10.1016/j.ijnurstu.2021.103986] [Medline: 34242979]
12. Lu M, Yu X, Zhang S, et al. A longitudinal qualitative study on the rehabilitation needs of liver transplant patients at different stages [Article in Chinese]. Chin J Nurs. 2026;61(5):660-666. [doi: 10.3761/j.issn.0254-1769.2026.05.012]
13. Artru F, Trovato F, Morrison M, Bernal W, McPhail M. Liver transplantation for acute-on-chronic liver failure. Lancet Gastroenterol Hepatol. Jun 2024;9(6):564-576. [doi: 10.1016/S2468-1253(23)00363-1] [Medline: 38309288]
14. Saracino RM, Jutagir DR, Cunningham A, et al. Psychiatric comorbidity, health-related quality of life, and mental health service utilization among patients awaiting liver transplant. J Pain Symptom Manage. Jul 2018;56(1):44-52. [doi: 10.1016/j.jpainsymman.2018.03.001] [Medline: 29526612]
15. Zhou H, Su M, Yang Z, Huang Y, He H, Xu L. Current status and attribute analysis of continuous care service needs for liver transplantation recipients [Article in Chinese]. Chin Nurs Manage. 2024;24(11):1738-1742. [doi: 10.3969/j.issn.1672-1756.2024.11.027]
16. Lara AN, Sartori AMC, de Soárez PC, et al. Healthcare resource utilization and costs of outpatient follow-up after liver transplantation in a university hospital in São Paulo, Brazil: cost description study. Sao Paulo Med J. 2015;133(3):171-178. [doi: 10.1590/1516-3180.2013.7000011] [Medline: 26039536]
17. Hong W. Advances and opportunities of mobile health in the postpandemic era: smartphonization of wearable devices and wearable deviceization of smartphones. JMIR mHealth uHealth. Jan 22, 2024;12:e48803. [doi: 10.2196/48803] [Medline: 38252596]
18. Portz J, Moore S, Bull S. Evolutionary trends in the adoption, adaptation, and abandonment of mobile health technologies: viewpoint based on 25 years of research. J Med Internet Res. Sep 27, 2024;26:e62790. [doi: 10.2196/62790] [Medline: 39331463]
19. Duettmann W, Naik MG, Zukunft B, et al. eHealth in transplantation. Transpl Int. Jan 2021;34(1):16-26. [doi: 10.1111/tri.13778] [Medline: 33111393]
20. Ji R, Yan W, Li Z, et al. Application and prospects of mobile health applications in the health management of organ transplant recipients [Article in Chinese]. Organ Transplant. 2025;16(3):474-481. [doi: 10.12464/j.issn.1674-7445.2025071]
21. Tang J, James L, Howell M, Tong A, Wong G. eHealth interventions for solid organ transplant recipients: a systematic review and meta-analysis of randomized controlled trials. Transplantation. Aug 2020;104(8):e224-e235. [doi: 10.1097/TP.0000000000003294] [Medline: 32732828]
22. Gao R, Feng SY, Zheng J, Zhai LJ, Liu R. Telehealth and telemedicine in the management of adult patients after liver transplantation: a scoping review. Telemed J E Health. Apr 2025;31(4):375-385. [doi: 10.1089/tmj.2024.0359] [Medline: 39630539]

23. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19-32. [doi: 10.1080/1364557032000119616]
24. Peters MDJ, Marnie C, Tricco AC, et al. Updated methodological guidance for the conduct of scoping reviews. JBI Evid Synth. Oct 2020;18(10):2119-2126. [doi: 10.11124/JBIES-20-00167] [Medline: 33038124]
25. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med. Oct 2, 2018;169(7):467-473. [doi: 10.7326/M18-0850] [Medline: 30178033]
26. Pollock D, Peters MDJ, Khalil H, et al. Recommendations for the extraction, analysis, and presentation of results in scoping reviews. JBI Evid Synth. Mar 1, 2023;21(3):520-532. [doi: 10.11124/JBIES-22-00123] [Medline: 36081365]
27. Issa DH, Alkhouri N. Long-term management of liver transplant recipients: a review for the internist. Cleve Clin J Med. Jun 2015;82(6):361-372. [doi: 10.3949/ccjm.82a.14072] [Medline: 26086495]
28. Lieber SR, Jones AR, Gowda P, et al. Survivorship interventions after liver transplantation (LT): a systematic review of interventions targeting physical and psychosocial well-being after LT. Liver Transpl. Feb 1, 2026;32(2):195-221. [doi: 10.1097/LVT.0000000000000682] [Medline: 40674286]
29. Wachholz LF, Knihs NDS, Sens S, Paim SMS, Magalhães ALP, Roza BDA. Good practices in transitional care: continuity of care for patients undergoing liver transplantation. Rev Bras Enferm. 2021;74(2):e20200746. [doi: 10.1590/0034-7167-2020-0746] [Medline: 34037143]
30. Brustia R, Monsel A, Skurzak S, et al. Guidelines for perioperative care for liver transplantation: Enhanced Recovery After Surgery (ERAS) recommendations. Transplantation. Mar 1, 2022;106(3):552-561. [doi: 10.1097/TP.0000000000003808] [Medline: 33966024]
31. Knihs NDS, Silva AMD, Grespi LDO, et al. Mobile game: educational technology for home care of patients undergoing liver transplantation. Texto Contexto - Enferm. 2024;33. [doi: 10.1590/1980-265x-tce-2023-0162pt]
32. Hickman IJ, Coran D, Wallen MP, et al. 'Back to Life'-using knowledge exchange processes to enhance lifestyle interventions for liver transplant recipients: a qualitative study. Nutr Diet. Sep 2019;76(4):399-406. [doi: 10.1111/1747-0080.12548] [Medline: 31083821]
33. Goswami A, Weinberg E, Coraluzzi L, et al. A tailored virtual program for alcohol use disorder treatment among liver transplant candidates and recipients is feasible and associated with lower post-transplant relapse. Clin Transplant. Jul 2024;38(7):e15381. [doi: 10.1111/ctr.15381] [Medline: 38940230]
34. Andrä M, Sibinovic M, Pfeiffer K, Kniepeiss D. Implementation of a mobile application for outpatient care after liver transplantation. Digit Health. 2022;8:20552076221145855. [doi: 10.1177/20552076221145855] [Medline: 36601283]
35. Delman AM, Turner KM, Jones CR, et al. Keeping the lights on: telehealth, testing, and 6-month outcomes for orthotopic liver transplantation during the COVID-19 pandemic. Surgery. Jun 2021;169(6):1519-1524. [doi: 10.1016/j.surg.2020.12.044] [Medline: 33589248]
36. Lee TC, Kaiser TE, Alloway R, Woodle ES, Edwards MJ, Shah SA. Telemedicine based remote home monitoring after liver transplantation: results of a randomized prospective trial. Ann Surg. Sep 2019;270(3):564-572. [doi: 10.1097/SLA.0000000000003425] [Medline: 31356267]
37. Tian M, Wang B, Xue Z, et al. Telemedicine for follow-up management of patients after liver transplantation: cohort study. JMIR Med Inform. May 17, 2021;9(5):e27175. [doi: 10.2196/27175] [Medline: 33999008]
38. Koc ÖM, Pierco M, Remans K, et al. Telemedicine based remote monitoring after liver transplantation: feasible in a select group and a more stringent control of immunosuppression. Clin Transplant. Jan 2022;36(1):e14494. [doi: 10.1111/ctr.14494] [Medline: 34596918]
39. Volk ML, Roney M, Fagerlin A. Pilot test of a patient decision aid about liver transplant organ quality. Liver Transpl. Jul 2014;20(7):850-855. [doi: 10.1002/lt.23882] [Medline: 24706409]
40. Bailey DE, Hendrix CC, Steinhauser KE, et al. Randomized trial of an uncertainty self-management telephone intervention for patients awaiting liver transplant. Patient Educ Couns. Mar 2017;100(3):509-517. [doi: 10.1016/j.pec.2016.10.017] [Medline: 28277289]
41. Konjeti VR, Heuman D, Bajaj JS, et al. Telehealth-based evaluation identifies patients who are not candidates for liver transplantation. Clin Gastroenterol Hepatol. Jan 2019;17(1):207-209. [doi: 10.1016/j.cgh.2018.04.048] [Medline: 29723691]
42. Hickman IJ, Hannigan AK, Johnston HE, et al. Telehealth-delivered, cardioprotective diet and exercise program for liver transplant recipients: a randomized feasibility study. Transplant Direct. 2021;7(3):e667. [doi: 10.1097/TXD.0000000000001118] [Medline: 33564717]
43. Dolanbay N, Ozkan M. The effect of web-based education on symptoms and adherence to immunosuppressive medications in liver transplant patients. Transplant Proc. Jun 2025;57(5):803-809. [doi: 10.1016/j.transproceed.2025.03.005] [Medline: 40300900]

44. Ertel AE, Kaiser TE, Abbott DE, Shah SA. Use of video-based education and tele-health home monitoring after liver transplantation: results of a novel pilot study. Surgery. Oct 2016;160(4):869-876. [doi: 10.1016/j.surg.2016.06.016] [Medline: 27499142]
45. Duarte-Rojo A, Bloomer PM, Grubbs RK, et al. Use of a mobile-assisted telehealth regimen to increase exercise in transplant candidates: a home-based prehabilitation pilot and feasibility trial. Clin Transl Gastroenterol. Nov 1, 2023;14(11):e00601. [doi: 10.14309/ctg.0000000000000601] [Medline: 37477616]
46. DeMartini KS, Schilsky ML, Palmer A, et al. Text messaging to reduce alcohol relapse in prelisting liver transplant candidates: a pilot feasibility study. Alcohol Clin Exp Res. Apr 2018;42(4):761-769. [doi: 10.1111/acer.13603] [Medline: 29498753]
47. Wang M, Shui AM, Barry F, et al. The tele-liver frailty index (TeLeFI): development of a novel frailty tool in patients with cirrhosis via telemedicine. Am J Transplant. Jul 2023;23(7):966-975. [doi: 10.1016/j.ajt.2023.04.012] [Medline: 37061188]
48. Catalli LL, Ha NB, Miller SA, et al. A shared medical appointment program to improve self-management of metabolic dysfunction-associated steatotic liver disease. Gastro Hep Adv. 2026;5(4):100903. [doi: 10.1016/j.gastha.2026.100903] [Medline: 41868859]
49. Lu XP, Jing XL, Gu SS. Application value of internet plus hospital-community-family integrated continuous nursing model in patients after liver transplantation [Article in Chinese]. Mod J Integr Tradit Chin West Med. 2023;32(13):1868-1872. [doi: 10.3969/j.issn.1008-8849.2023.13.024]
50. Wang Y, Wang L, Tian Y, Bai L. Application of online information platform in the follow-up management for liver transplantation patients. Chin J Mod Nurs. 2012;18(34):4176-4178. [doi: 10.3760/cma.j.issn.1674-2907.2012.34.027]
51. Li ZX, Zhang Q, Zhang DY, et al. Preliminary experience in the construction and application of a digital health management system for the whole lifecycle of organ transplant recipients [Article in Chinese]. Pract J Organ Transplant. 2024;12(6):539-542. [doi: 10.3969/j.issn.2095-5332.2024.06.011]
52. Liu J, Xie J, Liu L, et al. Effects of WeChat-based peer supports upon medication adherence in liver transplant recipients [Article in Chinese]. Chin J Organ Transplant. 2019;40(8):484-488. [doi: 10.3760/cma.j.issn.0254-1785.2019.08.008]
53. Zhai MM, Li L, Zhou YX, Li SY, Liu SS, Wang DH. Study on the effect of continuous nursing based on mobile medical platform in patients after liver transplantation [Article in Chinese]. Lab Med Clin. 2021;18(5):644-648. [doi: 10.3969/j.issn.1672-9455.2021.05.019]
54. Pan T, Wei L, Zhou Q, Yu J. The effect of WeChat education app combined with supervised family intervention on patients after liver transplantation [Article in Chinese]. J Qilu Nurs. 2023;29(4). [doi: 10.3969/j.issn.1006-7256.2023.04.010]
55. Sun M, Li N, Liu G, Huang WH, Liu JL, Ren YW. Evaluation of the effectiveness of multidisciplinary participation in continuity of care after liver transplantation through a WeChat platform [Article in Chinese]. Mod Dig Interv. 2019;24(S2):2616-2617. URL: https://d.wanfangdata.com.cn/periodical/CiBQZXJpb2RpY2FsQ0hJU29scjkyMDI2MTAxMjE5NTI0NxIXUUtWMjAxOTIwMjAwNDI4MDAwNzE5NjYaCGE3dmVwcmRw [Accessed 2026-11-07]
56. Tian BY, Lu HP, Zhang JQ, et al. Application of telemedicine robot in follow-up after liver transplantation from donation after cardiac death [Article in Chinese]. Organ Transplant. 2019;10(1):79-83. [doi: 10.3969/j.issn.1674-7445.2019.01.012]
57. Wang MM, Wang D, Huang XK. Application of remote rehabilitation management mode in postoperative follow-up of liver transplantation patients [Article in Chinese]. Chin J Mod Nurs. 2023;29(3):375-379. [doi: 10.3760/cma.j.cn115682-20220303-00992]
58. Xue Z, Tian M, Du YY, et al. Application of remote follow-up management system in transitional care of liver transplant recipients [Article in Chinese]. J Nurs Sci. 2019;34(21):73-76. [doi: 10.3870/j.issn.1001-4152.2019.21.073]
59. Eysenbach G, CONSORT-EHEALTH Group. CONSORT-EHEALTH: improving and standardizing evaluation reports of Web-based and mobile health interventions. J Med Internet Res. Dec 31, 2011;13(4):e126. [doi: 10.2196/jmir.1923] [Medline: 22209829]
60. Schnall R, Rojas M, Bakken S, et al. A user-centered model for designing consumer mobile health (mHealth) applications (apps). J Biomed Inform. Apr 2016;60:243-251. [doi: 10.1016/j.jbi.2016.02.002] [Medline: 26903153]
61. Rezaee R, Khashayar M, Saeedinezhad S, Nasiri M, Zare S. Critical criteria and countermeasures for mobile health developers to ensure mobile health privacy and security: mixed methods study. JMIR Mhealth Uhealth. Mar 2, 2023;11:e39055. [doi: 10.2196/39055] [Medline: 36862494]
62. Nieman CL, Oh ES. Connecting with older adults via telemedicine. Ann Intern Med. Nov 17, 2020;173(10):831-832. [doi: 10.7326/M20-1322] [Medline: 32777187]

63. Nimmanterdwong Z, Boonviriya S, Tangkijvanich P. Human-centered design of mobile health apps for older adults: systematic review and narrative synthesis. JMIR Mhealth Uhealth. Jan 14, 2022;10(1):e29512. [doi: 10.2196/29512] [Medline: 35029535]

Abbreviations

CONSORT-EHEALTH: Consolidated Standards of Reporting Trials of Electronic and Mobile Health Applications and Online Telehealth
JBI: Joanna Briggs Institute
LT: liver transplantation
mHealth: mobile health
PCC: population, concept, and context
PRISMA-ScR: Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
QoL: quality of life
RCT: randomized controlled trial

Edited by Alicia Stone; peer-reviewed by Boris Breznen, Takashi Matsusaki; submitted 07.Jul.2026; final revised version received 08.Sep.2026; accepted 22.Sep.2026; published 16.Nov.2026

Please cite as:
Shi W, Sun J, Li J, Li Y, Yuan F, Li R, Chu Z
Applications and Current Landscape of Digital Health Technologies in the Continuity of Care for Liver Transplant Candidates and Recipients: Scoping Review
JMIR Mhealth Uhealth 2026;14:e106470
URL: https://mhealth.jmir.org/2026/1/e106470
doi: 10.2196/106470

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