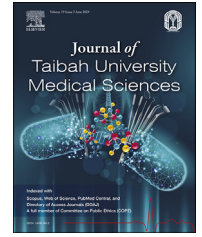




# Taibah University

## Journal of Taibah University Medical Sciences

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### Review Article

## Effectiveness of telenursing in improving quality of life in patients with heart failure: A systematic review and meta-analysis

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Received 4 January 2024; revised 11 February 2024; accepted 28 April 2024; Available online 10 May 2024



### المخلص

**أهداف البحث:** في مجال الخدمات الصحية، يعد التمريض عن بعد نظاماً معاصراً لتكنولوجيا المعلومات والاتصالات يتيح توفير الرعاية والخدمات التمريضية للمناطق النائية. لقد ثبت أن التمريض عن بعد يمكن أن يساعد في تحسين الصحة النفسية للمرضى المزمنين بشكل عام. ومع ذلك، لم يتم إجراء أي تقييم لتأثير التمريض عن بعد على مرضى قصور القلب. وللتأكد من كيفية تأثير علاجات التمريض عن بعد على نوعية حياة مرضى قصور القلب.

**طريقة البحث:** كانت معايير الاشتمال هي المقالات من 2015 إلى 2023 باللغة الإنجليزية. المشاركون الذين يعانون من قصور القلب مع تدخل التمريض عن بعد، كانت النتائج في شكل نوعية الحياة، وشملت البحوث تجربة منضبطة معيشة. معايير الاستبعاد هي الاضطرابات النفسية، ومراجعات الأدبيات، والمراجعات المنهجية، والمراجعات الشاملة. تم إجراء المراجعة في خمس قواعد بيانات: "بابميد"، "سكوبس"، "ويللي"، "بروكويست"، "اميرلاندا انسايت". تم إجراء التقييم النقدي باستخدام قائمة التقييم النقدي الخاصة بمعهد جونا بريجس.

**النتائج:** استوفت إحدى عشرة تجربة منضبطة معيشة (2032 مريضاً) معايير الاشتمال، وأظهرت هذه المراجعة أنه كان هناك تأثير كبير على نوعية الحياة بعد استخدام التدخل للتمريض عن بعد مع عدم تجانس عالي بنسبة 98٪.

**الاستنتاجات:** يمكن لتدخلات التمريض عن بعد أن تحسن نوعية حياة مرضى قصور القلب. لذلك يمكن تطبيق التمريض عن بعد في المستشفيات في تقديم الرعاية التمريضية لتوفير التعليم ومراقبة نوعية حياة مرضى قصور القلب عن بعد.

**الكلمات المفتاحية:** سكتة قلبية؛ الصحة المتنقلة؛ جودة الحياة؛ التمريض عن بعد؛ الرعاية الصحية عن بعد

### Abstract

**Introduction:** In the field of health services, telenursing is a contemporary information and communication technology system that enables the provision of nursing care and services to remote areas. Telenursing can increase psychological general well-being in patients with chronic conditions. Nevertheless, the effects of telenursing on patients with heart failure have not been examined.

**Objective:** This study was aimed at ascertaining how telenursing treatments affect quality of life in patients with heart failure.

**Method:** The inclusion criteria were articles from 2015 to 2023 in English, reporting quality of life outcomes for participants with heart failure in randomized controlled trials of telenursing interventions. The exclusion criteria were studies of psychiatric disorders, literature reviews, systematic reviews, and umbrella reviews. The systematic review was registered with PROSPERO registration number CRD42023484361. The review was conducted with five databases: PubMed, Scopus, Willey, Proquest, and Emerald Insight. Critical appraisal was conducted with the Joanna Briggs Institute's Critical Appraisal Checklist. The data were synthesized with Review Manager version 5.4.

**Results:** Eleven randomized controlled trials (2032 patients) met the inclusion criteria. A significant effect on quality of life was observed after telenursing intervention. The heterogeneity was high, at 98% (SMD = 1.05; 95% CI [0.12, 1.98];  $p = 0.03$ ).

**Conclusion:** Telenursing interventions can improve quality of life among patients with heart failure and therefore may be applied in hospitals providing nursing

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Peer review under responsibility of Taibah University.



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care, to remotely provide education and monitor the quality of life of patients with heart failure.

**Keywords:** Heart failure; Mobile health; Quality of life; Telehealth; Telenursing

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## Introduction

The leading cause of mortality is non-communicable illnesses, particularly cardiovascular disease. Heart failure is defined by the American Heart Association as the heart's inability to pump sufficient blood to maintain body functions. Abnormalities in heart structure and function result in hemodynamic imbalance due to the filling of the ventricles or the ejection of blood.<sup>1</sup> Dyspnea and tiredness, which cause exercise intolerance, and fluid retention, which cause pulmonary congestion and peripheral edema, are the typical signs of heart failure.<sup>2</sup> Every year, as many as 3.6 million patients in Europe receive a heart failure diagnosis. A total of 5.7 million people above 20 years of age in the US have heart failure. By 2030, a 46% increase in heart failure has been predicted. Heart failure is observed throughout Asia at a rate of 1.26–6.7%. Southeast Asian (13.0%) and East Asian nations (7.5%) have higher rates of heart failure-associated mortality than South Asian nations (7.3%).<sup>3</sup>

People with heart failure may experience a variety of issues that impair quality of life, including psychological issues such as frustration, disappointment, anxiety, and even melancholy.<sup>4</sup> Most people with heart failure experience poorer quality of life than individuals with other chronic ailments. Many aspects, such as physical restrictions, general health, social function, emotional constraints, and mental health, affect quality of life.<sup>5</sup> The New York Heart Association has noted that sex and age are important factors in determining the prevalence of heart failure. With aging, physical function decreases both mentally and physically. Likewise, men are more likely than women to have better physical ability, particularly physical fitness. The effects of diminished physical capacity influence quality of life.<sup>6</sup>

According to the New York Heart Association, heart failure is classified into four levels. At level 1, individuals can perform normal activities. At level 2, individuals experience mild symptoms, such as shortness of breath or angina, when performing activities. At level 3, individuals show real limitations in activities and are comfortable at rest. At level 4, severe limitations occur, and individuals experience symptoms even at rest, thus influencing their ability to maximize the body condition and affecting their quality of life. This factor can be influenced by education level and knowledge when the problem is recognized.<sup>7</sup>

Numerous studies have demonstrated that telenursing treatments can enhance quality of life among individuals with heart failure. The health industry uses telenursing, an information and communication technology system, to offer long-distance nursing and care services.<sup>8</sup> Instead of having

face-to-face meetings, patients and their caregivers communicate through media made available to patients and their families. Many care domains can benefit from the application of telenursing practices, such as home visits; secure email messaging systems with hotline support; discharge planning; chronic telenursing in the department; telenursing for illnesses and emergencies, including outpatient care; call center services; triage; and discharge planning. A wide variety of media are available, including email, mobile health, personal digital assistants, mobile applications, landlines, and cellphones.<sup>9</sup>

Patients with chronic conditions, including heart failure, can be supervised through lifestyle education in areas including medication adherence, nutritional management, stress management, and exercise.<sup>10</sup> Likewise, nurses can monitor blood pressure in for patients with hypertension through an automatic blood pressure monitoring device. Abnormal results in all these controls can contribute to health education through various telenursing media.<sup>11</sup> Telenursing, a field that relies heavily on information technology, offers many benefits to patients, healthcare workers, and governments; its direct and tangible benefits include enhanced cost and time efficiency. With remote care, the range of nursing care services continues to expand.<sup>12</sup>

Telenursing is emerging as a promising solution leveraging technology to offer nursing and care services remotely. Telenursing can be provided via a mobile application, website, or telephone follow-up. Patients can receive education in independent heart care at home, and their health conditions can subsequently be monitored by telephone two or three times per week. Prior systematic reviews have been conducted in this field. For example, one review has examined the effects of telenursing aimed at preventing hospital revisitation on the readmission of patients with heart failure. That study examined the efficacy of therapy and has found that telehealth achieves good results in improving quality of life in patients with heart failure.<sup>13</sup> Leutually et al. reviewed health education regarding self-care (nutritional management, low sodium diet, physical activity, and stress management) provided by telenursing, and have found that telenursing improves self-care and consequently quality of life in patients with heart failure.<sup>14</sup>

However, no meta-analysis had specifically assessed the effects of telenursing on quality of life among patients with heart failure. Therefore, we sought to examine the effectiveness of telenursing in improving quality of life among patients with heart failure through a systematic review and meta-analysis.

## Materials and Methods

### *Search strategy*

The recommended reporting items for systematic reviews, according to PRISMA standards, were followed in this investigation. The protocol for the review was released and filed in PROSPERO with registration CRD42023484361. The inclusion criteria were articles published with open access in English between 2015 and 2023, with the full article text available. The participants were required to be patients

with heart failure, the intervention was required to be tele-nursing, the outcome was required to be quality of life, and the research design was required to be a randomized controlled trial. The exclusion criteria were studies in patients with comorbidities or patients with psychiatric disorders, literature reviews, systematic reviews, and umbrella reviews. PubMed, Scopus, Willey, Proquest, and Emerald Insight were the journal databases used as search tools. Keywords used in advanced searches are described in Table 1.

#### Selection of relevant studies

The specific requirements for study eligibility were ascertained according to the PIOS framework. Adults with heart failure diagnoses made up the study populations. The intervention was telenursing. Continuous education or counseling for managing personal health, as managed and administered by a nurse, was provided through a mobile application, landline, or cellphone. In this study, the intervention was compared with normal care, which was defined as a post-discharge face-to-face conversation with a physician or nurse without any telenursing instruction. The nurse subsequently educated the patient and offered advice or counseling.

Articles identified from the search were entered into EndNote X9 bibliography software. After elimination of duplicates, two reviewers independently screened the article titles and abstracts. The abstracts of selected articles were further analyzed. If doubt existed regarding the inclusion of a research article in the second stage of article selection, the entire article (full text) was reviewed, and the doubts were resolved by discussion with other reviewers. The selection of articles in this systematic review was consistent with the PIOS framework.

#### Critical appraisal

Two reviewers independently evaluated the methodological quality of the qualifying studies with data from the Joanna Briggs Institute (JBI) critical assessment reporting system. The reviewers of each study assigned a rating of “yes,” “no,” “unclear,” or “not applicable” for each of the assessment tool’s major criteria. Quality was classified according to Heratanti et al., and the proportion of “yes” responses to the critical evaluation findings with the JBI tool

was used to compute the overall score. The JBI Critical Evaluation Tool Checklist for Randomized Controlled Trials. Gaps discovered during the research quality assessment process were resolved as necessary, through discussions with other reviewers (see Table 2).

#### Synthesis of data

A narrative synthesis was performed to describe the collected studies. The mean values and standard deviations of the post-intervention findings are provided in the results. Standardized mean differences (SMDs) were computed to quantify the effects of the intervention on the experimental group compared with the control group, when studies used various outcome measures. Review Software Review Manager (version 5.4.1) was used for statistical analysis of how telenursing affects quality of life in patients with heart failure. Through examination and computation of the  $I^2$  test, the statistical heterogeneity of the included studies was determined; values <25% were considered low, values >75% were considered high, and values 25–75% were considered moderate. In the systematic review, a P value <0.05 was used as the threshold for statistical significance (see Table 3).

## Results

#### Study selection

A total of 2844 articles were collected from the journal databases. Fifteen articles were eliminated after removal of duplicates, the titles and abstracts were verified, and a thorough text check was conducted. The quality of 13 publications was subsequently evaluated, and two articles with scores below 75% were excluded. The systematic review included 11 articles meeting the inclusion criteria (Figure 1).

#### Sample characteristics

A total of 2032 individuals in total were divided into an intervention group of 1008 participants and a control group of 1024 participants at random. The nations included China, n = 1; the US, n = 2; Germany, n = 1; India, n = 1; Iran, n = 2; Indonesia, n = 1; Japan, n = 1; Korea, n = 1; and Singapore, n = 1. Eleven articles discussed various telenursing approaches, five discussed mobile applications, four discussed telephone

**Table 1: Keywords in advanced searches.**

Data based	Search strategy	Hasil
Scopus	“heart failure” AND telenursing OR telephone AND “quality of life” AND “randomized controlled trial”	2.275
PubMed	((((“heart failure” [Mesh]) AND “telenursing” [Mesh]) OR “mobile health” [Mesh]) AND “quality of life” [Mesh]) AND “randomized controlled trial”	403
Emerald	heart failure AND (telenursing) OR (mobile health) AND (quality of life) AND (randomized controlled trial)	34
ProQuest	heart failure AND (telenursing) OR (telehealth) AND (quality of life) AND (randomized controlled trial)	99
Wiley	“heart failure” AND “telenursing” AND “quality of life” AND “randomized controlled trial”	33

**Table 2: Critical appraisal.**

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Arjunan and Trichur (2021) <sup>15</sup>	Y	Y	Y	Y	U	Y	U	Y	Y	U	Y	Y	Y
Athilingam et al. (2017) <sup>16</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bakitas et al. (2020) <sup>17</sup>	Y	Y	Y	Y	Y	N	Y	Y	Y	U	Y	Y	U
Choi et al. (2023) <sup>18</sup>	Y	Y	Y	Y	U	U	Y	N	Y	Y	Y	Y	Y
Davoudi et al. (2020) <sup>19</sup>	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Hudiyawati et al. (2023) <sup>20</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Jiang et al. (2021) <sup>21</sup>	Y	Y	Y	Y	N	U	Y	Y	Y	Y	Y	Y	Y
Khajehpoor et al. (2023) <sup>22</sup>	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Mizukawa et al. (2019) <sup>23</sup>	Y	Y	Y	Y	Y	N	Y	U	Y	Y	Y	Y	Y
Voller et al. (2022) <sup>24</sup>	Y	Y	Y	N	N	Y	U	Y	Y	Y	Y	Y	Y
Yu et al. (2015) <sup>25</sup>	Y	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y

List of JBI critical appraisal items for randomized controlled trials: Q1: Did participants' assignment to treatment groups follow genuine randomization? Q2: Was the assignment to treatment groups kept a secret? Q3: At baseline, were treatment groups comparable? Q4: Were participants unaware of their assigned treatment? Q5: Were those administering the therapy unaware of the assignment of the treatment? Q6: Aside from the intervention of interest, were treatment groups handled in the same way? Q7: Did outcome assessors overlook the assignment of treatments? Q8: Did treatment groups' results get the same measurements? Q9: Were results measured in an accurate manner? Q10: Was follow-up done, and if not, were the differences in follow-up between the groups adequately analyzed and explained? Q11: Were the individuals examined within the groups they were assigned at random? Q12: Did the right statistical analysis come into play? Q13: Was the trial design suitable, and did the conduct and analysis of the study account for any deviations from the standard RCT design, such as individual randomization and parallel groups?

**Table 3: Data extraction.**

Author (year), country	Design	Participant		Disease types	Intervention	Control group	Measurement tools	Outcome
		E/C	Mean age. Total E/C					
Arjunan et al. (2021) India	RCT	Experiment n = 100 Control n = 100	Total 59.57+(11.16)	Heart failure grades 2 and 3	This nurse-run CR initiative included methodical guidance on how to manage conditions through diet, exercise, medicine, home care, smoking cessation, and lifestyle modifications. After testing, all intervention group members received telephone calls every 2 weeks for 3 months.	Usual care e.g., physician visits, nursing care, physiotherapy	Minnesota Living with Heart Failure Questionnaire (MLHFQ)	After 3 months of telephone heart health education delivered every 2 weeks, the nurse-led program was shown to improve quality of life.
Athilingam et al. (2017) US	RCT	Experiment n = 9 Control n = 9	Total 53.06+(4.02)	Heart failure grades 2 and 3	HeartMapp is a research-led application. HeartMapp elements including daily weight measurement, symptom evaluation, reacting to individual alerts, use of a BioHarness 3 chest strap to monitor vital signs, HR training (CHF-Info), and breathing and walking exercises were covered throughout the training. For a total of 4 weeks, participants were required to use HeartMapp every day from home.	Usual care for heart failure	Kansas City Cardiomyopathy Questionnaire (KCCQ)	The HeartMapp application enhanced the intervention group's quality of life after 1 month of treatment.
Bakitas et al. (2020) US	RCT	Experiment n = 208 Control n = 207	Experiment 63.5+(8.0) Control 64.1+(9.1)	Heart failure grades 3 and 4	The telehealth intervention involved six sessions facilitated by a cardiac nurse. Each session required approximately 30–40 min. Session 1 discussed heart disease. The second session emphasized self-care, healthy eating, physical activity, and smoking cessation. Physical and psychological symptoms were covered in session 3. The importance of comprehension, advance care planning, and	Usual care for heart failure	Kansas City Cardiomyopathy Questionnaire (KCCQ)	After a 16-week telemedicine intervention, individuals with heart failure reported an improvement in quality of life.

Cho et al. (2023) Korea	RCT	Experiment n = 38 Control n = 38	Experiment 70.31+ (10.55) Control 79.42 (7.59)	Heart Failure grades 1–4	<p>decision-making assistance were discussed in session 4. Reflection on life and legacy building were the topics of sessions 5 and 6.</p> <p>The application “Heart Failure–Smart Life” was used. The initial meeting lasted half an hour. By guiding patients through the application features, nurses provided instruction on how to perform daily physical activities and record information, such as exercise and nutritional status. The nursing staff reviewed patient medical records on a daily basis, and communicated internally through chat and telephone capabilities. This intervention was performed over 3 months and was supervised by three cardiac nurses.</p>	Standard treatment for heart failure	40-item MacQuantification of Health-Related Quality of Life in New Heart Disease Patients	After 3 months, the intervention group’s quality of life was enhanced by the Heart Failure-Smart Life application.
Davoudi et al. (2020) Iran	RCT	Experiment n = 60 Control n = 60	Experiment 50.07 (11.77) Control 52.78 (12.2)	Heart failure grades 2 and 3	<p>This smartphone application directed by nurses included guidance and teaching regarding heart disease via telephone or chat. Patients tracked their symptoms, collected vital signs, and logged them in the application. Patients received weekly notifications for six consecutive weeks, followed by monthly notifications for approximately 2 months, to remind them to use the application.</p>	Usual care including providing brochures and how to take medicine	Minnesota Living with Heart Failure Questionnaire (MLHFQ).	Patients with heart failure who used a smartphone application had better quality of life.
Hudiyawati et al. (2023) Indonesia	RCT	Experiment n = 71 Control n = 70	Experiment 60.3(7.8) Control 62.1(8.3)	Heart failure grades 2 and 3	<p>Telemonitoring interventions in heart failure education were conducted. A 20-min telephone call each week was used to discuss patient status, heart failure symptoms, and medication adherence</p>	Standard treatment for heart failure	Minnesota Living with Heart Failure Questionnaire (MLHFQ).	After 4 weeks of telemonitoring, individuals with heart failure experienced improvements in quality of life.

(continued on next page)

Table 3 (continued)

Author (year), country	Design	Participant		Disease types	Intervention	Control group	Measurement tools	Outcome
		E/C	Mean age. Total E/C					
Jiang et al. (2021) Singapore	RCT	Experiment n = 70 Control n = 72	Experiment 66.82+(11.81) Control 68.82+(13.14)	Heart Failure grades 1–4	issues, as well as home care challenges, such as activity and eating habits. This intervention was performed for 4 weeks. M-Health was nurse-led and included a variety of features, such as individually scheduled reminders for doctor's appointments, medications, and cardiovascular training; logging weight, blood pressure, and symptoms; and a chat room for communicating with research nurses.	Usual care for heart failure	Minnesota Living with Heart Failure Questionnaire (MLHFQ).	HOM-HEMP was a successful intervention for increasing quality of life in patients with heart failure.
Khajehpoor et al. (2023) Iran	RCT	Experiment n = 50 Control n = 50	Experiment 27 (57.4) Control 26 (44.7)	Heart failure grades 3 and 4	Home telephone education included nursing assessment, education, counseling, and emotional support. Researchers were on call 24 h per day, depending on participant needs, to help participants resolve any issues. The intervention was performed over eight sessions.	Usual care for heart failure	Quality of Life Index (QLI).	Quality of life was improved by telephone palliative care provided at home. The telephone might be useful for enhancing quality of life in patients with heart failure.
Mizukawa et al. (2019) Jepang	RCT	Experiment n = 20 Control n = 19	Experiment 74.5 ± (12.1) Control 70.5 ± 13.3	Heart failure grades 1–3	Through a smartphone application, nurse observation was conducted for an entire year. Patients were provided with a notebook to log daily self-monitoring information, including blood pressure, pulse, and body weight. Intervention nurses provided monthly counseling interventions for the first 6 months. Each session lasted 30 min. The intervention nurse reviewed the data each morning at 10 a.m. and evaluated patient notes regarding laboratory data each month during monthly sessions.	Usual care for heart failure	Minnesota Living with Heart Failure Questionnaire (MLHFQ).	At 18 and 24 months, a remote monitoring intervention enhanced quality of life in patients with heart failure.

Voller et al. (2022) Germany	RCT	Experiment n = 302 Control n = 319	Total 63.0+(11.5)	Heart failure grades 2–4	This remote telemonitoring intervention connected patients and healthcare providers wirelessly via a telemedicine platform. The intervention helped manage disease conditions and allowed physicians to communicate with patients every day from home. Patients were asked to measure their vital signs (blood pressure, heart rate, and body weight) every day. This information was sent over a secure broadband connection to the hospital workstation, and a telephone call was made if errors occurred.	Usual care	Kansas City Cardiomyopathy Questionnaire (KCCQ)	Remote telemonitoring, significantly increased quality of life after a year in patients with heart failure.
Yu et al. (2015) China	RCT	Experiment n = 80 Control n = 80	Experiment 59.7+(11.3) Control 59.0+(10.3)	Heart failure grades 2–4	The intervention involved educational brochures and researcher-led telephone follow-up regarding heart failure education, weight monitoring, medication, lifestyle changes, and nutritional management. The researchers contacted participants weekly for 4 weeks.	Usual care	Minnesota Living with Heart Failure Questionnaire (MLHFQ).	Quality of life in patients with heart failure is enhanced by health education and telephone follow-up visits.



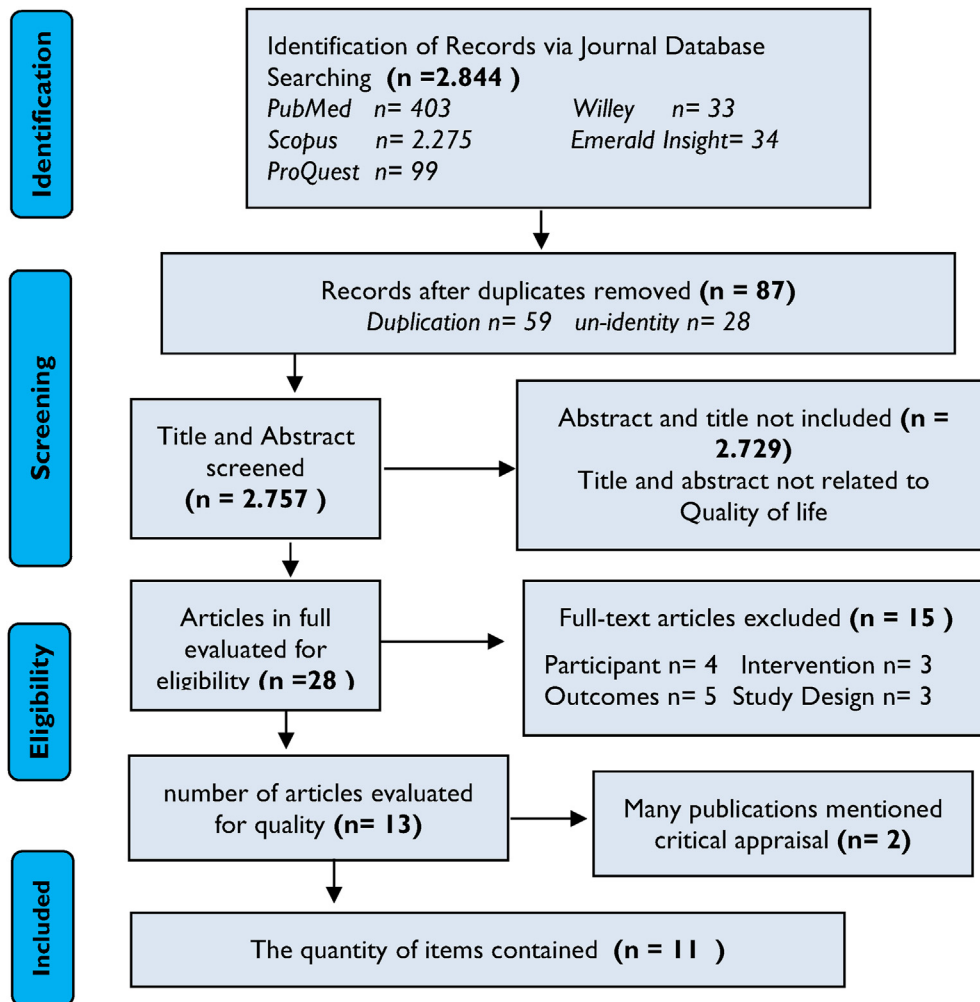


Figure 1: PRISMA.

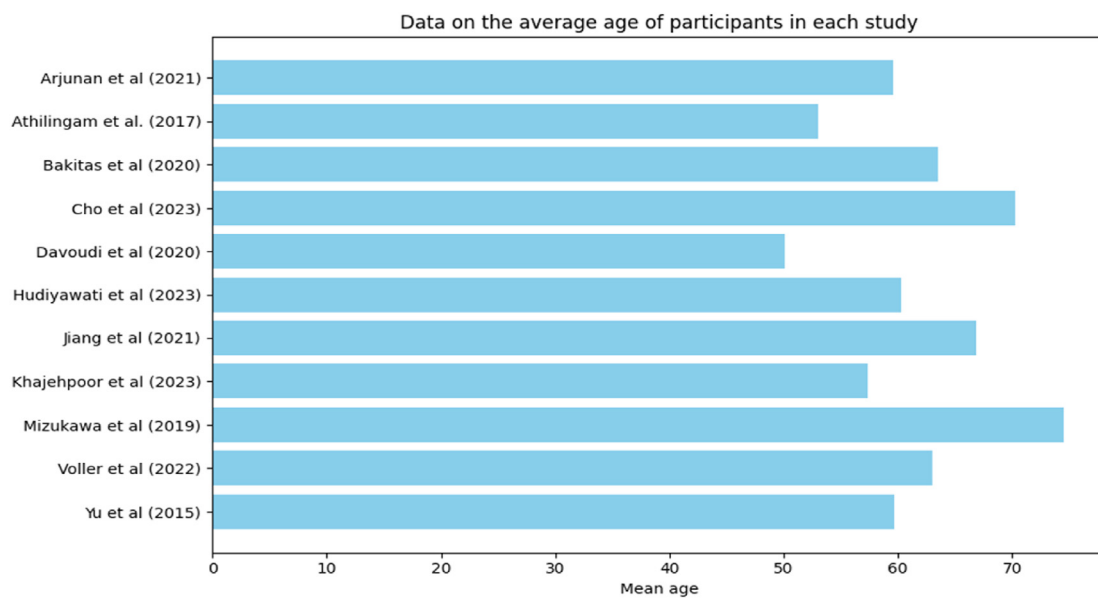


Figure 2: Mean age.

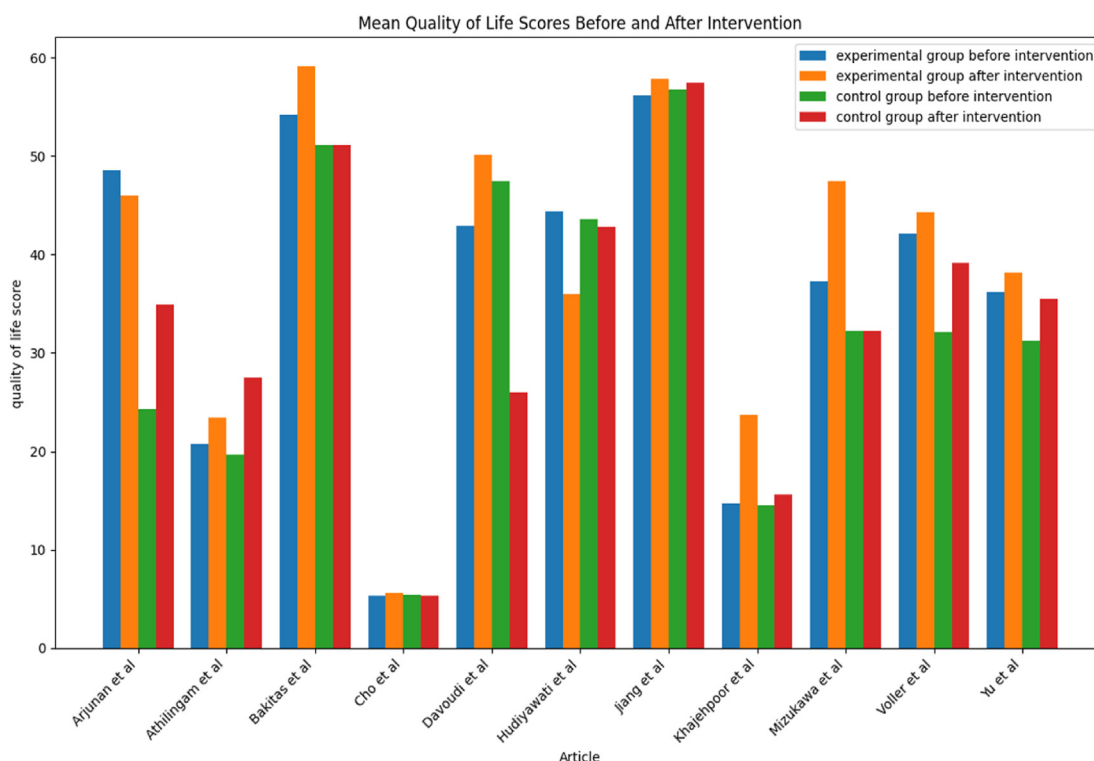


Figure 3: Mean QoL score before and after intervention.

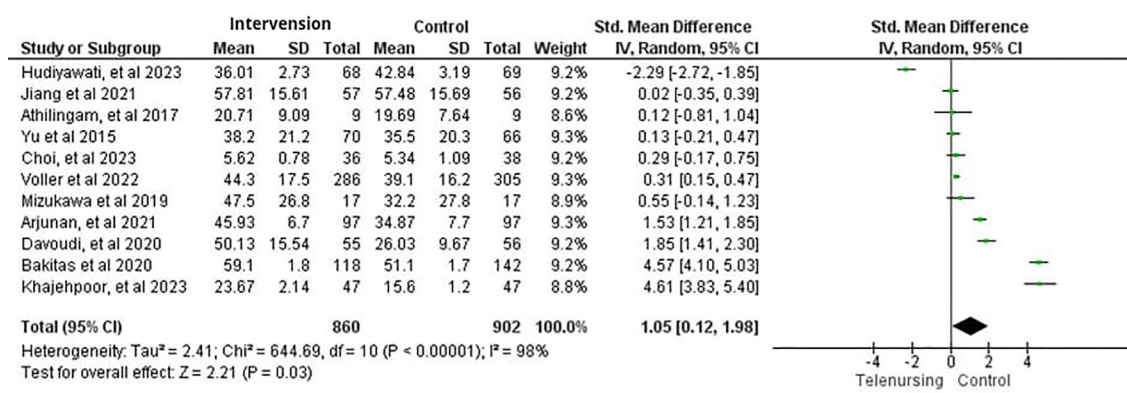


Figure 4: Forest plot.

follow-up, and two discussed hospital integrated telehealth systems. The included trials had an intervention frequency of one to three weekly call sessions. Periods of 4 weeks–12 months were allotted for the interventions. The quality of life of patients with heart failure was demonstrated to be significantly improved by all therapies.

Eleven RCTs met the inclusion criteria in Figures 2 and 3. With high heterogeneity (98%), the overall review analysis demonstrated considerable effects on quality of life after telenursing intervention. Because the research instruments differed across studies, the SMD was used (SMD = 1.05 95% CI, [0.12, 1.98],  $\rho = 0.03$ ). Subgroup analysis with the MLHFQ questionnaire also showed significant effects on quality of life after intervention, with a high heterogeneity of 99% (SMD = 7.34 95% CI, [-3.63, 18.31],  $\rho 0.19$ ) (Figures 4

and 5). The KCCQ questionnaire also indicated a significant effect, with a high heterogeneity of 71% (SMD = 6.17 95% CI, [3.19, 9.15],  $\rho 0.0001$ ). The funnel plot indicated that publication bias was low among the 11 studies (see Figure 6).

**Discussion**

This review examined how telenursing can help people with heart failure live better lives. Eleven studies were analyzed and synthesized to determine the effects of the interventions. After the interventions, patients' quality of life was found to significantly improve. This result was consistent with prior findings by Arian et al.<sup>26</sup> Quality of life in patients with heart failure can be enhanced by the use of telerehabilitation technology, which enables provision of

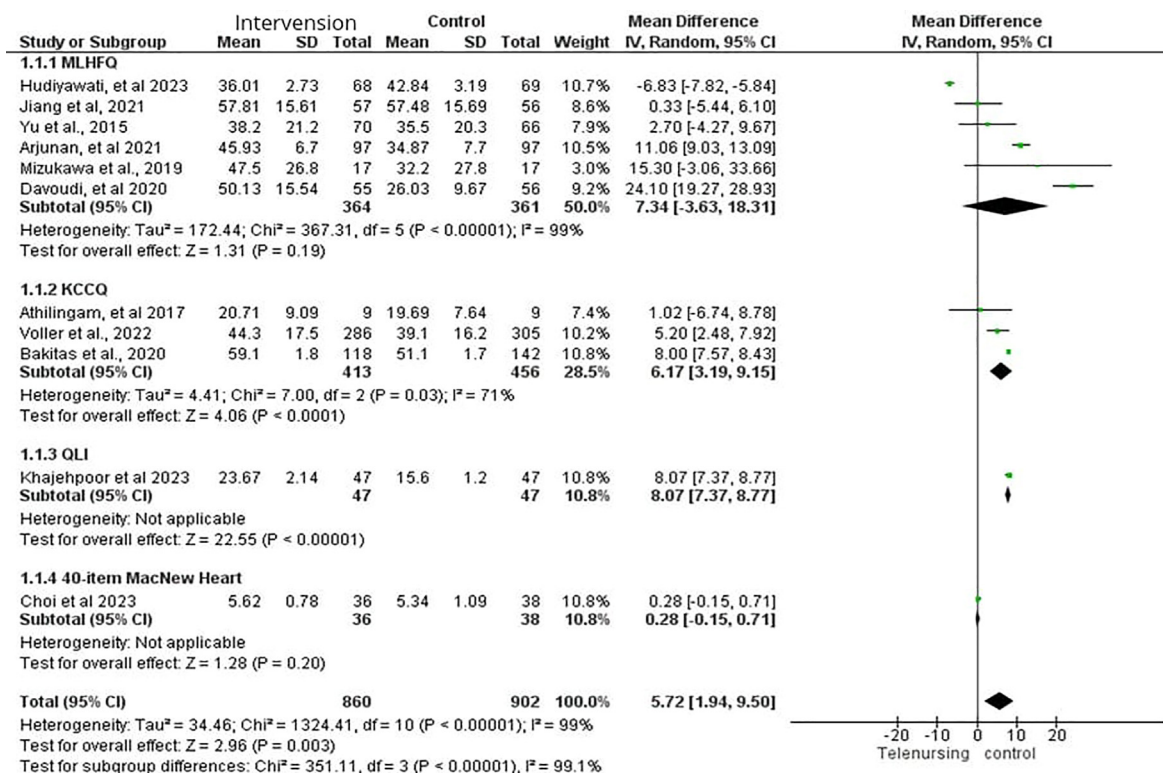


Figure 5: Forest plot subgroups.

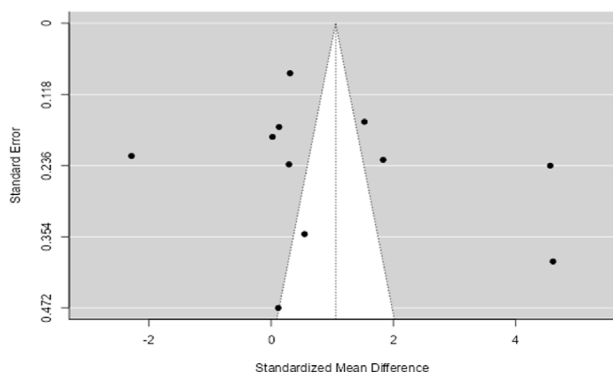


Figure 6: Funnel plot.

therapy services in locations with limited access. Furthermore, after telemedicine-based heart failure management interventions, the quality of life among patients with heart failure has been found to improve<sup>27</sup> Virtual clinics, disease-related information, and psychological support were offered by both these trials, thus demonstrating how telenursing may enhance quality of life in patients with heart failure. Eleven of the included studies demonstrated that the intervention favorably enhanced quality of life. Heart failure illness education, medication adherence, patient physical activity monitoring, vital sign monitoring, and information to enhance health literacy are among the interventions that have been offered.<sup>28</sup>

Virtual self-monitoring enables patients to access care remotely. Through m-health applications, telenursing can facilitate changes in health behavior and offer a comprehensive

picture of a patient’s state. Mobile applications are helping to increase patient physical activity monitoring, but further research is required to clarify how patient quality of life is affected. According to our review, telenursing improved patients’ quality of life. According to one included study, patients regularly access information related to health behavior education. The improvement in health behavior after the use of m-health was consistent with findings from other systematic reviews indicating improvements in health behavior.<sup>29</sup> However, as recommended by Bonn et al., the use of telenursing should be considered a supplemental intervention to direct nursing interventions.

This systematic review has many limitations regarding consequences and restrictions. First, participant blinding decreased the quality of this review, because some articles used single blinding rather than double or triple blinding. Second, potential for heterogeneity existed in the different grades of heart failure, and telenursing intervention frequency and content among the included trials, thus potentially influencing the data gathered. Third, the variety of research currently accessible limited the investigation of effect mechanisms.

Limitations in communication exist in telenursing, which often faces obstacles in facilitating effective communication between nurses and patients. Limitations in physical examination also applied, because telenursing cannot replace an in-person physical examination by a nurse or medical professional. Another limitation was limited technology access, given that all people might not have easy or sufficient access to the technology necessary for telenursing, such as a stable internet connection or appropriate devices.

Thus, to precisely understand the processes underlying the effects of telenursing, high-quality randomized controlled trials and standardized telenursing standards are required. Patients with heart failure may experience improvement in their quality of life with telenursing treatments, according to the findings of our review of 11 included research studies. While receiving cardiac therapy, individuals may find that the characteristics offered help them live better. When nursing care is provided to assist patients with heart failure achieve healthy habits, interventions may provide a cooperative alternative.

## Conclusion

This meta-analysis of 11 articles showed that telenursing improves quality of life among patients with heart failure. Quantitative synthesis demonstrated beneficial results in improving quality of life among patients with heart failure. The quality of the evidence varied from fair to excellent. However, the results should be interpreted with caution, because of variations in the frequency and content of telenursing. Further standardization is needed to investigate the effects of interventions, such as the content of heart failure education and frequency of education, to better understand the effects of treatment.

## Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflict of interest

The authors have no conflict of interest to declare.

## Ethical approval

The standards for the recommended reporting items for systematic reviews (PRISMA) were followed in every step of the process. The review was registered under registration number CRD42023484361 in the International Register of Prospective Systematic Reviews (PROSPERO).

## Authors contributions

HA: search for relevant literature, collection of data, statistical analysis, idea, design, and production of the article. EM: evaluation of the text and final approval of the published version. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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**How to cite this article:** Ariyanto H, Rosa EM. Effectiveness of telenursing in improving quality of life in patients with heart failure: A systematic review and meta-analysis. *J Taibah Univ Med Sc* 2024;19(3):664–676.