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Quality of life of chronic heart failure patients: a systematic review and meta-analysis

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Abstract

Despite various individual studies on the quality of life (QOL) in patients with CHF, a comprehensive study has not yet been conducted; therefore, this study aims to assess the QOL of CHF patients. In the present systematic review and meta-analysis, PubMed, Scopus, and the Web of science databases were searched from January 1, 2000, to December 31, 2018, using QOL and heart failure as keywords. The searches, screenings, quality assessments, and data extractions were conducted separately by two researchers. A total of 70 studies including 25,180 participants entered the final stage. The mean QOL score was 44.1 (95% confidence interval (CI) 40.6, 47.5; $I^2 = 99.3\%$) using a specific random effects method in 40 studies carried out on 12,520 patients. Moreover, according to the geographical region, heart failure patients in the Americas had higher scores. In 14 studies, in which a general SF-36 survey was implemented, the average physical component score (PCS) and mental component score (MCS) were 33.3 (95% CI 31.9, 34.7; $I^2 = 88.0\%$) and 50.6 (95% CI 43.8, 57.4; $I^2 = 99.3\%$), respectively. The general and specific tools used in this study indicated moderate and poor QOL, respectively. Therefore, it is necessary to carry out periodic QOL measurements using appropriate tools as part of the general care of CHF patients.

Keywords Heart failure · Quality of life · Meta-analysis

Introduction

Today, chronic heart failure (CHF) is a serious global health challenge. According to the most recent 2019 data, more than 6.2 million people in the USA are afflicted with CHF, which is projected to reach over 8 million by 2030 [1]. World Health Statistics from 2012 alone show that heart failure (HF) has created an additional burden of 180 million dollars in the health system [2]. Different physical and mental complications such as fatigue, depression, anxiety, edema, shortness of breath due to the chronic and prolonged disease course, and therapeutic processes have a serious and negative impact on the quality of life (QOL) of CHF patients resulting in lower QOLs compared with healthy individuals and other patients with chronic illnesses [2–9]. Lower QOLs correlate with increased hospitalization times and mortality rates, and higher costs imposed on health systems, families, and patients [10–12].

Therefore, the regular assessment of a patients' QOL and health promotion are key measures in increasing their survival rates [13, 14]. QOL is a multidimensional concept that is affected by economic and social factors, life satisfaction, and the severity and stage of their HF (15, 16). QOL is usually assessed using general and specific tools with previous studies primarily having been focused on the identification of QOL measuring tools (17). Despite numerous individual studies, there have been no comprehensive studies on the exact QOL status of CHF patients. This comprehensive study will help to determine the exact QOL status of HF patients at global and

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regional levels and on the various income levels of their countries.

QOL has been also studied on the basis of separate specific and general tools, so that we can help healthcare personnel and patients identify the elements needed to support a better QOL. The aim of the present study was to assess the QOL of CHF patients.

Methods

Eligibility criteria and search strategy

This systematic review and meta-analysis was carried out using the Cochran's book and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was used to report [15]. The study protocol has been registered in PROSPERO (CRD42019135720).

Inclusion criteria included all the studies that used at least one of the standard specific or general tools for measuring QOL and were published in peer-reviewed journals in English language, descriptive observational articles, and clinical trials containing basic information about participants' QOL. The target participants with CHF aged over 15 years old, studies which have been conducted on at least 25 people and from 1 January 2000 to 31 December 2018.

Exclusion criteria included the studies that were published in non-English language and published before 2000, also review, qualitative, letter to editor studies were excluded. Studies that did not meet the minimum quality scores were also excluded. Since only studies using standardized scores were used to calculate quality of life included, studies that used raw scores to determine quality of life were excluded.

Three databases (PubMed, Scopus, and Web of science) were searched. The latest search process was carried out on 10 January 2019 to prepare the search strategy, the Boolean operators (AND, OR, and NOT), Medical Subject Headings (MeSH), truncation "*" and related text words was used. Keywords used included quality of life and heart failure.

Selection of studies and data extraction

Searching, screening, data extraction, and quality assessment were performed by two researchers (R.A.G, S.B). According to the study protocol, the studies were reviewed, and the duplicates were excluded. Studies were then reviewed by title and abstract, respectively, and the unrelated ones were excluded. Then the remaining studies entered the final stage. The extracted data items included the first author; year of publication; region based on WHO category, socioeconomic status based on world bank category, country; sampling method; age; design; stage of HF; and instrument characteristics, gender, risk of bias, and quality of life score.

Quality assessment and data synthesis

To evaluate the methodological quality of the studies, two different tools were used based on the type of study. To evaluate the quality of descriptive studies, Hoy et al.'s 10-item tool was used and assessed the studies for external and internal validity [16]. Moreover, Jadad's tool was used to assess the risk of bias in two clinical trials [17]. All the eligible studies were included in the synthesis after a systematic review. Data were combined with the forest plot. The quality of life in heart failure patients was evaluated by random-effects model. The heterogeneity of the preliminary studies was evaluated with I2 tests. Sub-group analysis was conducted to determine heterogeneity based on the type of tools, gender, and publication year. Meta-analysis was performed using STATA 14 (StataCorp, Texas, USA) statistical software.

Results

Study selection

A total of 5022 articles were found while searching four databases. After excluding duplicate articles, 2349 articles entered the next phase where articles were reviewed in terms of title and abstract, of which 2149 articles were excluded due to lack of meeting the inclusion criteria. At the last phase, 200 full-text articles were reviewed, of which 70 articles had the inclusion criteria. Out of 130 articles were also excluded for reasons included review ($n = 13$), qualitative ($n = 3$), no quality ($n = 3$), no full text ($n = 18$), non-English $n = (34)$, letter to editor ($n = 18$), and used raw score to determine the QOL (1) [18] (Fig. 1).

Study characteristics

A total of 70 studies carried out 25,180 patients with HF in 23 countries from 2001 to 2018 entered the final phase. Most studies were conducted in Americans ($n = 27$) and European ($n = 25$). Most studies were conducted in countries with high SDI ($n = 67$). Most studies ($n = 40$) used consecutive sampling. The most commonly used general and specific tools used included SF-36 ($n = 15$) and MLHFQ ($n = 41$). The type of studies included descriptive ($n = 65$), cohort ($n = 2$), and RCT studies ($n = 3$). Also, most of studies were multicenter studies ($n = 53$). Of the 50,916 people, 28,371 were nurses. All of the studies entered had low bias risk and good quality (Table 1)

Main results

Instruments

Various general and specific tools were used in 70 studies entered. Similar type of general or specific tool was used to measure quality of life in 53 studies, and more than one type of tool was used in other studies. The general tools included SF-36 (*n* = 14), ED-5Q (*n* = 6), WHOQOL-BREF (*n* = 3), and SF-12(*n* = 3). Specific tools included MLHFQ (*n* = 41), KCCQ (*n* = 9), MQOL (*n* = 2), and other tools included DHP, CDC HRQOL, CCHFQ, HFSS, LVD-36, MacNew , MILQ, NHP, QLI, and quality of life index. The full details of used instruments including full name, abbreviation, type of questioner (general/specific), dimensions and items, scores mentioned in Supplementary Table 1.

Quality of life

Quality of life based on specific tools: *MLHFQ* Using 41 studies and 12,578 participants, the QOL was assessed by The Minnesota Living with Heart Failure Questionnaire (MLHFQ). In these studies, the mean of the total QOL score reported in 40 studies (12,520 patients) was between 13.0 and 66.9. Based on the results of the random effects model, the pooled mean of the total QOL was 44.1 (95% CI 40.6, 47.5; I^2 = 99.3%). Subgroup analyses based-on continents, showed the pooled mean of the total QOL score in Americans (48.0) was higher than Europe (45.5) and Asia (35.1), and the difference with Asia was statistically significant (*p* value = 0.014) (Fig. 2). Therefore, based on total MLHFQ scores, the health-related quality of life (HRQOL) in Asian HF patients was better than in American patients, indicating less of a disease impact in Asians.

Target population in five studies and mean age of 15 studies was higher than 60 years. Nineteen studies with 4080 participants and 20 studies with 8046 participants were categorized as adult and elderly age groups, respectively. Subgroup analysis based on age groups revealed that the pooled mean total QOL score in the adult group [41.2 (95% CI 33.5, 48.9; I^2 = 99.4%)] was lower than in the elderly group [46.6 (95% CI 43.0, 50.2; I^2 = 99.1%)] (*p* value = 0.154) indicating that heart failure in elderly patients probably has a larger effect on their QOLs.

The physical and emotional subscales of quality of life scale were assessed and reported in 24 out of 40 studies. Based on the results of the random effects method, the pooled mean of the physical and emotional subscales was 20.1 (95% CI 17.4, 22.9; I^2 = 99.3%) and 8.8 (95% CI 7.5, 10.1; I^2 = 98.6%), respectively. Subgroup analysis based on continents showed that the pooled mean of the physical and emotional subscales in America were higher than in Europe or Asia. For

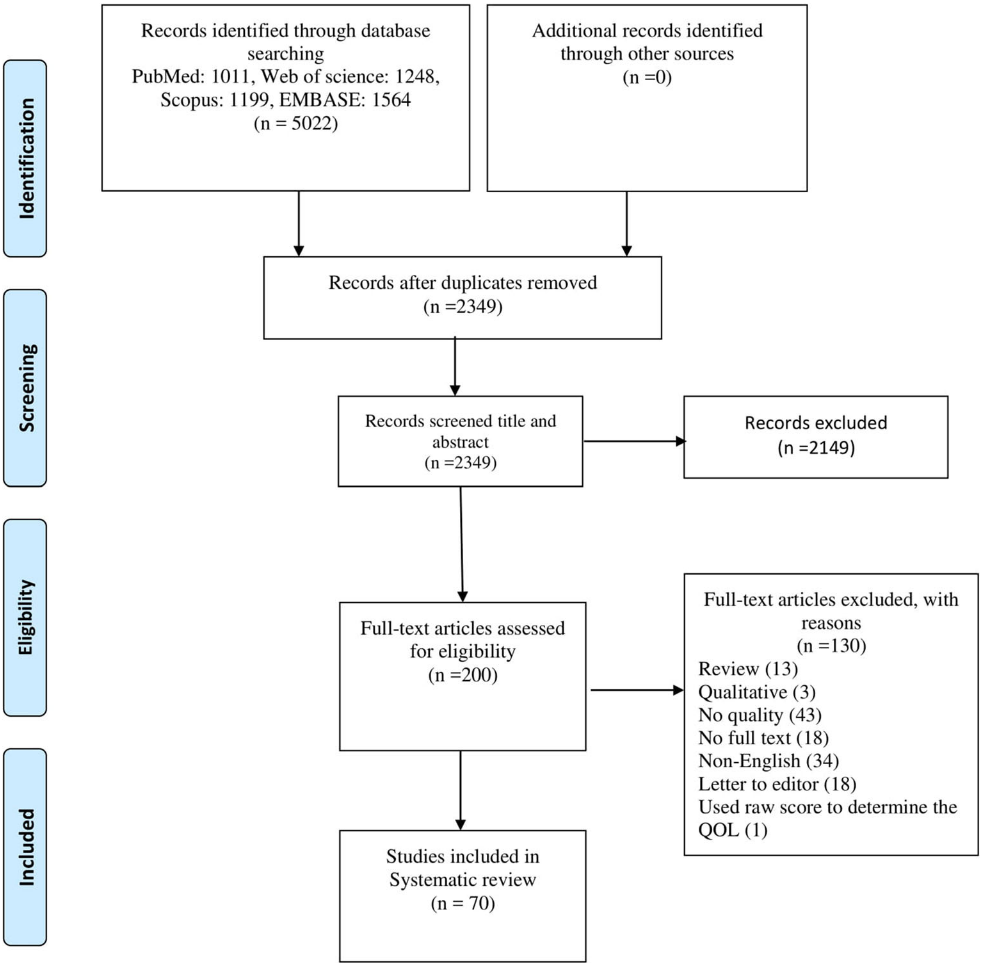

Fig. 1 Study selection process

Table 1 Methodology characteristic of included studies

ID	Author	Year	Country	Region	SDI	Sampling method	Questionnaire1.Name2.Type of questionnaire	Participants	Age (m)	Male	Female	Risk of bias
1	Aburuz, M. E. [19]	2015	Saudi Arabia	EMRO	High SDI	Convenience	1.SF-362.General	103	50.3	60	43	Low
2	Alaloul, F. [20]	2017	Saudi Arabia	EMRO	High SDI	Consecutive	1.SF-362.General	99	56.9	64	35	Low
3	Alla, F. [21]	2002	France	European	High SDI	Consecutive	1.Duke Health Profile, LIHFE2.General, and specific	108	64	83	25	Low
4	Arestedt, K. [22]	2013	Sweden	European	High SDI	Consecutive	1.SF-12, MLHFQ2.General, and specific	349	79	186	163	Low
5	Audi, G. [23]	2017	Greece	European	High SDI	Convenience	1.MLHFQ 2.Specific	300	60	167	133	Low
6	Auld, J. P. [24]	2018	USA	Americas	High SDI	Convenience	1.MLHFQ 2.Specific	202	57	101	101	Low
7	Azevedo, A. [25]	2008	Portugal	European	High SDI	Simple random	1.SF-36 2.General	424	61.6	184	240	Low
8	Bean, M. K. [26]	2009	USA	Americas	High SDI	Available	1.MLHFQ 2.Specific	97	53	65	32	Low
9	Bennett, S. J. [27]	2001	USA	Americas	High SDI	Census	1.CHFQ 2.Specific	227	65	110	117	Low
10	Berg, J. [28]	2014	Sweden	European	High SDI	Consecutive	1.NHP 2.Specific	177	75.5	99	78	Low
11	Blinderman, C. D. [29]	2008	USA	Americas	High SDI	Convenience	1.MILQ 2.Specific	103	67.1	74	29	Low
12	Borumandpour, M. [30]	2016	Iran	EMRO	High middle SDI	Convenience	1.WHOQOL-BREF, 2.General	147	63	77	70	Low
13	Britz, J. A. [31]	2010	USA	Americas	High SDI	Convenience	1.MLHFQ 2.Specific	30	70.69	19	11	Low
14	Brostrom, A. [32]	2004	Sweden	European	High SDI	Convenience	1.SF-36, MLHFQ2.General and specific	223	75	133	90	Low
15	Buck, H. G. [33]	2012	USA, Australia	Americas, Australia	High SDI	Available	1.MLHFQ 2.Specific	207	72.9	121	86	Low
16	Cal, A. [34]	2017	Turkey	European	High middle SDI	Convenience	1.MacNew 2.Specific	180	65.97	93	87	Low
17	Carels, R. A. [35]	2004	USA	Americas	High SDI	Consecutive	1.MLHFQ 2.Specific	58	67.7	33	25	Low
18	Carson, P. [36]	2009	USA	Americas	High SDI	Simple random	1.MLHFQ 2.Specific	1050	56.0	630	420	Low
19	Chan, H. Y. [37]	2016	China	Western Pacific	High SDI	Convenience	1.MQOL 2.Specific	112	82.9	65	47	Low
20	Chen, H. M. [38]	2010	Taiwan	South-East Asia	High SDI	Convenience	1.KCCQ 2.Specific	125	67.79	69	56	Low
21	Chu, S. H. [39]	2014	South Korea	Western Pacific	High SDI	Consecutive	1. WHOQOL-BREF MLHFQ 2. General and specific	114	65.8	55	59	Low
22	Comin-Colet, J. [40]	2016	Spain	European	High SDI	Consecutive	1. ED-5Q, KCCQ2. General and specific	1037	70.6	728	309	Low
23	De Leon, C. F. M. [41]	2009	USA	Americas	High SDI	ND	1.SF 36, QLI2.General and specific	695	63.3	368	327	Low
24	De Rivas, B. [42]	2008	Spain	European	High SDI	Consecutive		2161	70.9	1200	961	Low

Table 1 (continued)

ID	Author	Year	Country	Region	SDI	Sampling method	Questionnaire1.Name2.Type of questionnaire	Participants	Age (m)	Male	Female	Risk of bias
							1. ED-5Q, MLHFQ2. General and specific					
25	Demir, M. [43]	2011	Turkey	European	High middle SDI	Convenience	1.LVD-36 2.Specific	75	63.7	38	37	Low
26	DeWolfe, A. [44]	2012	USA	Americas	High SDI	Convenience	1.MLHFQ2.Specific	314	63.2	233	81	Low
27	Edwards, M. K. [45]	2016	USA	Americas	High SDI	Consecutive	1.CDC HRQOL, 2.General	190	66.7	106	84	Low
28	Ekman, I. [46]	2002	Sweden	European	High SDI	Purposive	1.SF-36 2.General	158	81	76	82	Low
29	Enjuanes, C. [47]	2014	International	ND	ND	Consecutive	1.MLHFQ 2.Specific	1278	68	882	396	Low
30	Erceg, P. [48]	2013	Serbia	European	Upper middle SDI	Consecutive	1.MLHFQ 2.Specific	136	77.8	77	59	Low
31	Fotos, N. V. [49]	2013	Greece	European	High SDI	Census	1.MLHFQ 2.Specific	199	uk	124	75	Low
32	Franzén, K. [50]	2007	Sweden	European	High SDI	Convenience	1.SF-12, MLHFQ2.General and specific	357	79.3	187	170	Low
33	Gallagher, A. M. [51]	2018	United Kingdom	European	High SDI	Consecutive	1. ED-5Q, KCCQ, and MLHFQ2. General and specific	152	68.3	111	41	Low
34	Gott, M. [52]	2006	United Kingdom	European	High SDI	Convenience	1.SF-36, KCCQ2.General and specific	542	ND	293	249	Low
35	Hägglund, L. [53]	2007	Sweden	European	High SDI	Consecutive	1.SF-36 2.General	49	77.7	21	28	Low
36	Hallas, C. N. [54]	2011	United Kingdom	European	High SDI	Consecutive	1.WHOQOL-BREF, MLHFQ2.General and specific	146	48.6	120	26	Low
37	Hatmi, Z. N. [55]	2007	Iran	EMRO	High middle SDI	Simple Random	1.SF-36, MLHFQ2.General and specific	230	51.4	112	118	Low
38	Heo, S. [56]	2007	USA	Americas	High SDI	Consecutive	1.MLHFQ 2.Specific	90	74.8	48	42	Low
39	Heo, S. [57]	2012	USA	Americas	High SDI	Consecutive	1.MLHFQ 2.Specific	147	61.2	103	44	Low
40	Hou, N. [58]	2004	USA	Americas	High SDI	Convenience	1.MLHFQ 2.Specific	165	57.6	79	86	Low
41	Huang, T. Y. [59]	2010	Taiwan	South-East Asia	High SDI	Consecutive	1.MLHFQ 2.Specific	175	72.5	94	81	Low
42	Hwang, S. L. [60]	2014	Taiwan	South-East Asia	High SDI	Consecutive	1.MLHFQ 2.Specific	133	64.2	104	29	Low
43	Iqbal, J. [61]	2010	United Kingdom	European	High SDI	Consecutive	1.ED-5Q, MLHFQ2.General and specific	179	71	128	51	Low
44	Jaarsma, T. [62]	2005	Netherland	European	High SDI	Convenience	1.MLHFQ 2.Specific	231	75	123	108	Low
45	Jorge, A. J. L. [63]	2017	Brazil	Americas	High middle SDI	Consecutive	1.SF-36 2.General	59	71.1	23	36	Low
46	Juenger, J. [4]	2002	Germany	European	High SDI	Consecutive	1.SF-36 2.General	205	54	173	32	Low

Table 1 (continued)

ID	Author	Year	Country	Region	SDI	Sampling method	Questionnaire1.Name2.Type of questionnaire	Participants	Age (m)	Male	Female	Risk of bias
47	Kato, N. [64]	2011	Japan	Western Pacific	High SDI	Consecutive	1.MLHFQ 2.Specific	114	64.7	84	30	Low
48	Kaul, P. [65]	2013	Canada, USA	Americas	High SDI	Consecutive	1.ED-5Q 2.General	3141	72	2045	1096	Low
49	Lee, K. S. [66]	2014	USA	Americas	High SDI	Consecutive	1.MLHFQ 2.Specific	209	61	158	51	Low
50	Lesman-Leegte, I. [67]	2009	USA	Americas	High SDI	Consecutive	1.SF-36 2.General	781	72	500	281	Low
51	Liu, M. H. [68]	2011	Taiwan	South-East Asia	High SDI	Consecutive	1.MLHFQ 2.Specific	105	64	54	51	Low
52	Loo, D. W. [69]	2016	Singapore	Western Pacific	High SDI	Convenience	1.MLHFQ 2.Specific	121	64.08	81	40	Low
53	Luo, N. [70]	2018	USA	Americas	High SDI	Simple Random	1.KCCQ 2.Specific	2038	60	1457	581	Low
54	Lupon, J. [71]	2013	Spain	European	High SDI	Consecutive	1.MLHFQ 2.Specific	1151	69	825	326	Low
55	Macabasco-O'Connell, A. [72]	2011	USA	Americas	High SDI	Block random	1.KCCQ 2.Specific	585	60.7	314	271	Low
56	Masoudi, F. A. [73]	2004	USA	Americas	High SDI	Consecutive	1.KCCQ 2.Specific	546	52	416	130	Low
57	Pantilat, S. Z. [74]	2016	USA	Americas	High SDI	Consecutive	1.MLHFQ 2.Specific	104	53	69	35	Low
58	Patidar, A. B. [75]	2011	India	South-East Asia	Low middle SDI	Consecutive	1.KCCQ 2.Specific	50	43.26	37	13	Low
59	Pelegrino, V. M. [76]	2011	Brazil	Americas	High middle SDI	Convenience	1.MLHFQ 2.Specific	130	55.1	77	53	Low
60	Pressler, S. J. [77]	2010	USA	Americas	High SDI	Consecutive	1.MLHFQ 2.Specific	249	62.9	158	91	Low
61	Ramos, S. [78])	2017	Portugal	European	High SDI	Consecutive	1.SF-36, KCCQ2.General and specific	130	69	86	44	Low
62	Riegel, B. [79]	2003	USA	Americas	High SDI	Consecutive	1.MLHFQ 2.Specific	640	66.7	320	320	Low
63	Rodriguez-Artalejo, F. [14]	2005	Spain	European	High SDI	Consecutive	1.SF-36, MLHFQ2.General and specific	394	77.21	173	221	Low
64	Saccomann, Icrd [80])	2010	Brazil	Americas	High middle SDI	Convenience	1.SF-36 2.General	170	67.5	99	71	Low
65	Silavanich, V. [81]	2018	Thailand	South-East Asia	High middle SDI	Consecutive	1.MLHFQ 2.Specific	180	63.1	110	70	Low
66	Son, Y. J. [82]	2012	South Korea	Western Pacific	High SDI	Consecutive	1.MLHFQ 2.Specific	134	67.8	49	85	Low
67	Sousa, M. M. [83]	2017	Brazil	Americas	High middle SDI	Consecutive	1.MLHFQ 2.Specific	84	58.82	39	45	Low
68	Yu, D. S. [84]	2004	China	Western Pacific	High SDI	Consecutive	1.CHFQ 2.Specific	227	77.1	118	109	Low
69	Yu, D. S. [85]	2016	China	Western Pacific	High SDI	Consecutive	1.MQOL 2.Specific	119	82.9	62	57	Low

Table 1 (continued)

ID	Author	Year	Country	Region	SDI	Sampling method	Questionnaire1.Name2.Type of questionnaire	Participants	Age (m)	Male	Female	Risk of bias
70	Zachariah, D. [86]	2017	United Kingdom	European	High SDI	Consecutive	1.SF-12, MLHFQ2.General and specific	240	77	141	99	Low

SF-36 The Short Form-36, *LIHFE* Minnesota Living with Heart Failure Questionnaire, *SF-12* The Short Form-36, *MLHFQ* The Minnesota Living with Heart Failure Questionnaire, *CHFQ* Chronic Heart Failure Questionnaire, *NHP* Nottingham Health Profile, *MILQ* The Meaning in Life Questionnaire, *WHOQOL-BREF* WHO Quality of Life-BREF, *MacNew* MacNew Heart Disease Health-related Quality of Life, *KCCQ* Kansas City Cardiomyopathy Questionnaire, *QLI* quality of life index , *LVD-36* The left ventricular dysfunction questionnaire-36, *CDC HRQOL* CDC- Health-related quality of life, *UK* unknown, *M* month

the physical subscale, the difference between America and Asia was significant (21.4 vs. 12.5; *p* value < 0.001) (Supplementary Table 2).

The pooled mean of the physical subscale in elderly patients was 1.5 times greater than that of the adult age group (22.9 (95% CI 20.0, 25.9; I^2 = 99.0%) vs. 15.4 (95% CI 10.5, 20.3; I^2 = 99.2%); *p* value = 0.014). The pooled mean of the emotional subscale in elderly patients was 1.4 times greater than that of the adult age group (9.8 (95% CI 8.5, 11.0; I^2 = 97.5%) vs. 7.0 (95% CI 5.1, 9.0; I^2 = 97.9%); *p* value = 0.028).

The total MLHFQ score by gender was reported in 15 out of 40 studies. For 2174 male and 1,724 female patients, the pooled mean total MLHFQ score was 40.7 (95% CI 36.6, 44.9; I^2 = 96.7%) and 45.6 (95% CI 42.1, 49.1; I^2 = 93.3%), respectively (*p* value = 0.087). The QOL for female patients was lower than that in male patients, and this difference was also apparent in continental subgroups (Fig. 2). Out of 15 studies, 7 included physical and emotional subscales. The pooled means of the physical subscales in male and female patients were 19.2 (95% CI 16.2, 22.2; I^2 = 97.0%) and 20.4 (95% CI 17.7, 23.1; I^2 = 95.6%), respectively (*p* value = 0.562), and 8.5 (95% CI 7.4, 9.6; I^2 = 91.9%) and 9.3 (95% CI 7.7, 10.9; I^2 = 94.5%), respectively for the emotional subscales (*p* value = 0.413) (Supplementary Fig. 1).

Quality of life based on general tools: SF-36 Twenty-one studies used the short form (SF) health survey to assess the QOL. Fourteen out of 21 studies used the SF-36 with all eight scaled scores, but one study reported using only the physical functioning (PF) scale. Three studies used the shorter SF-12 version and reported the physical component summary (PCS) and the mental component summary (MCS). Four studies using the SF-36 assessed and reported two summary scales (PCS, MCS). Each of the eight health concepts was measured on a scale from 0 to 100 with higher scores indicating better health.

Based on the results of the random effects method, the pooled means of the PCS and the MCS scales for 2034 patients (1061 male and 973 female) were 33.3 (95% CI 31.9, 34.7; I^2 = 88.0%) and 50.6 (95% CI 43.8, 57.4; I^2 = 99.3%), respectively.

The mean score of general health perception was between 26.8 and 67.0, and the global pooled mean was 44.9 (95% CI 40.8, 49.0; I^2 = 97.4%). Subgroup analysis showed that the pooled mean of general health perception in America was 1.4 times higher than that in Asia (*p* value = 0.036) (Fig. 3).

Using a seven scale SF-36 (vitality, body pain, mental health, physical functioning, physical role, emotional role, and social functioning), the global pooled mean for physical role functioning (40.5) produced the lowest QOL scores and social role functioning produced the highest (64.8). In America, the pooled mean of physical functioning (47.2)

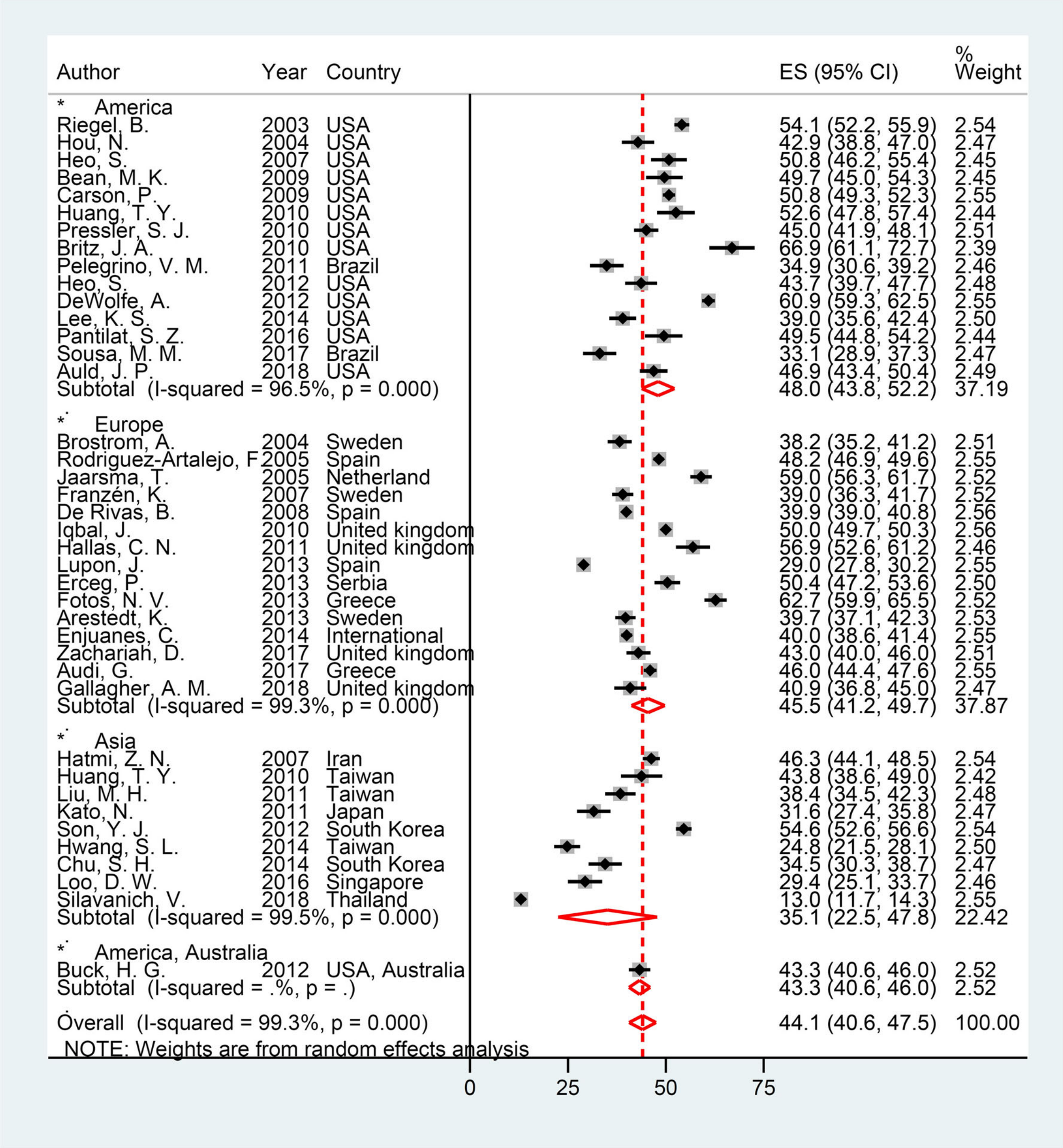

Fig. 2 Forest plot of total QoL score of MLHFQ based-on random effect model in chronic heart failure patients by continent

had the lowest QOL score, and the emotional role functioning (79.1) had the highest QOL score. The pooled mean of mental health (52.6) had the highest QOL score in Asia. The mean scores for general health perceptions and for the other seven scales were higher in America than in Europe or Asia. The differences of the pooled means between America and Asia were significant in bodily pain, mental health, and social role functioning (p value < 0.05) (Table 2).

Quality of life based on other tools The QOL in HF patients was assessed in 8 global studies using the Kansas City Cardiomyopathy Questionnaire (KCCQ). In seven of these, the overall summary score was calculated and reported by summing the scores of the physical limitations, symptoms, QOL, and social-functioning domains. The mean overall summary score for 4272 participants was 55.0 to 70.5 and the pooled mean was 60.9 (95% CI 56.2, 65.5; I^2 = 96.9%). The KCCQ subscale was assessed in only three studies.

The QOL in 6 global studies was assessed using the ED-5Q questionnaire. In the health state description component, 4 studies reported an overall score and the pooled mean was 0.608 (95% CI 0.569, 0.647; I^2 = 97.6%) with the lower pooled mean score being self-care and the higher pooled mean score being daily activities. In the evaluation component of the ED-5Q, five studies used a visual analog scale (VAS) and the pooled mean of the VAS was 54.6 (95% CI 48.4, 60.8; I^2 = 99.3%). Sixteen studies investigated the QOL of HF patients with 13 other tools (Supplementary Table 3).

Meta-regression

The results of univariate meta-regression analyses based-on MLHFQ, showed gender of participants (male-to-female ratio) variable not significantly contributed to heterogeneity of total mean score and sub-scale of QoL in the world ($P > 0.05$); but, publication year of study and continent showed a significant heterogeneity (Coef. = − 0.93, $P = 0.023$, and Coef. = − 6.1, $P = 0.006$), that explained 10.9% and 16.8% of between-study variation. Based-on sub-scale of MLHFQ, significant association only shown in physical sub-scale and continent (Coef. = − 4.1, $P = 0.020$) (Supplementary Fig. 3).

Discussion

Quality of life

The goal of all physical and mental treatments is to improve the QOL for CHF patients. This systematic review and meta-analysis was conducted to evaluate the QOL of CHF patients from 2000 to 2018. A total of 70 studies performed on 25,180 patients entered the final stage. The most commonly used special tool was the MHLFQ. The MHLFQ tool was used as a specific tool to assess patients' QOLs in 40 studies. Meta-analysis results indicated that the mean QOL in HF patients was 44.1. Based on the cutoff point in the MHLFQ tool, a higher score indicated a lower QOL, so that scores less than 24, 24–45, and above 45 indicated a good, moderate, and poor QOL, respectively [87]. Therefore, the results of the present study indicate a moderate to poor QOL in HF patients. According to the literature searches carried out by researchers, there have been no systematic reviews that investigated the QOL of HF patients based on the MHLFQ tool.

The results also showed that HF patients had a poorer QOL in the USA compared with other parts of world, yet the exact cause of this difference is not known. However, this result could have been due to the differences in the sample sizes of the studies from different parts of the world selected for this review, most of which were from the Americas. It is also possible that these results are due to an inequality of access to HF care services and the differences in the severity of symptoms in various racial groups [88].

The results also showed that the physical and mental scores in the elderly age group were 1.5 and 1.4 times higher than that of the adult age group, although these differences were not statistically significant. The results also showed that the QOL in the elderly age group was more disrupted than in adults with HF, which was consistent with previous studies in terms of disrupted dimensions, but it is inconsistent with previous studies regarding overall QOL scores [89–91].

The difference may be due to the type and sample size of the comparative studies since the present study is a review with sample sizes higher than in previous individual studies. The average QOL score was 40.7 in men and 45.6 in women, which indicated that the female QOL was more disrupted, which is consistent with the previous individual study [92]. This difference can be attributed to the effect of the different sample sizes of women and men surveyed in the present study. It can also be due to the difference in the time taken for

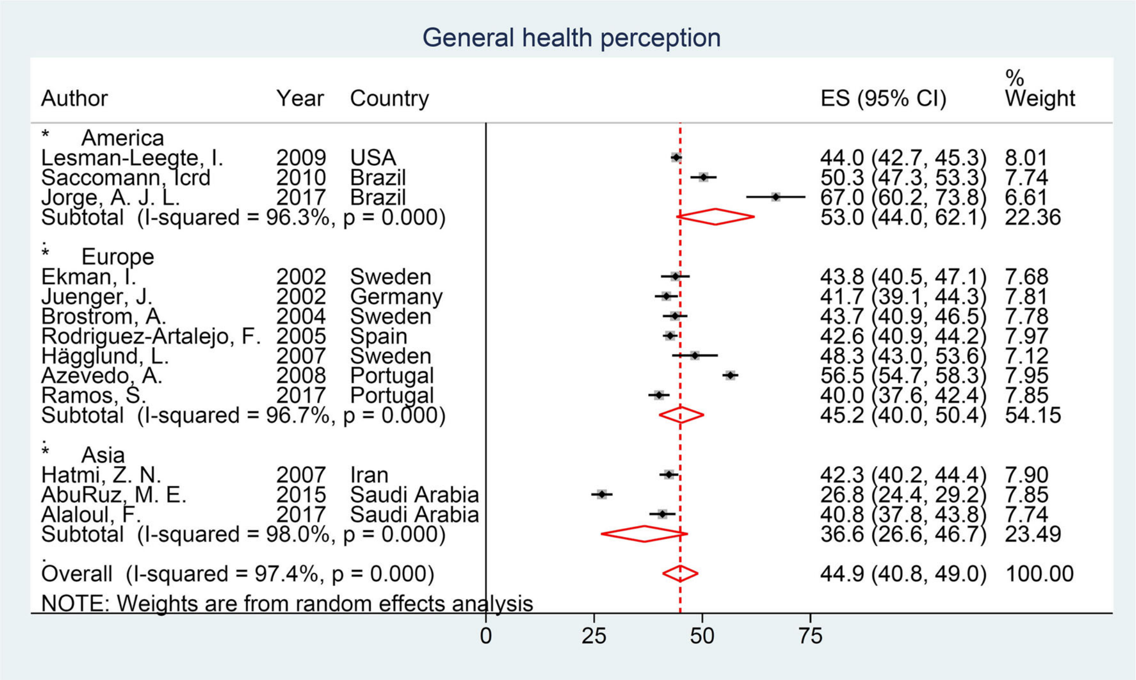

Fig. 3 Forest plot and meta-analysis of general health perception of SF-36 in heart failure patients in the world and continent sub-groups

Table 2 Meta-analysis of seven scale of SF-36 in heart failure patients in the world and continent sub-groups

First author (year)	Country	Vitality ES (95%CI)	Body pain ES (95%CI)	Mental health ES (95%CI)	Physical functioning ES (95%CI)	Physical role ES (95%CI)	Emotional role ES (95%CI)	Social functioning ES (95%CI)
Lesman-Leegte (2009) [67]	America	40.0 (38.3, 41.7)	66.0 (63.7, 68.3)	66.0 (64.4, 67.6)	49.3 (47.5, 51.1)	19.0 (16.6, 21.4)	51.0 (48.6, 53.4)	54.0 (51.8, 56.2)
Saccomann (2010) [80]	America	53.7 (50.7, 56.7)	70.4 (65.8, 75.0)	65.7 (62.5, 68.9)	35.0 (33.2, 36.8)	64.1 (57.4, 70.8)	86.3 (79.6, 93.0)	77.4 (73.4, 81.4)
Jorge (2017) [63]	America	65.0 (57.2, 72.8)	80.0 (70.1, 89.9)	78.0 (70.4, 85.6)	51.6 (48.6, 54.6)	100 (100, 100)	100 (100, 100)	87.0 (77.9, 96.1)
De Leon (2009) [41]	America				55.0 (44.3, 65.7)			
Sub-group pooled ES		52.4 (39.9, 65.0)	70.5 (64.5, 76.5)	68.2 (63.9, 72.6)	47.2 (37.7, 56.8)	61.0 (0.0, 122.6)	79.1 (42.1, 116.1)	72.5 (52.5, 92.4)
Juenger (2002) [4]	Europe	42.8 (39.8, 45.8)	63.1 (58.8, 67.4)	61.2 (58.4, 64.0)	48.3 (44.6, 52.0)	25.5 (20.4, 30.6)	49.1 (44.0, 54.2)	68.5 (64.8, 72.2)
Ekman (2002) [46]	Europe	35.4 (31.7, 39.1)	61.8 (57.0, 66.6)	68.9 (65.4, 72.4)	39.9 (36.4, 43.4)	25.3 (20.0, 30.6)	61.6 (56.3, 66.9)	75.4 (70.7, 80.1)
Brostrom (2004) [32]	Europe	45.4 (42.1, 48.7)	58.6 (54.7, 62.5)	71.4 (68.7, 74.1)	43.9 (40.4, 47.4)	31.2 (27.1, 35.3)	54.1 (50.0, 58.2)	70.2 (66.5, 73.9)
Rodriguez-Artalejo (2007) [14]	Europe	34.8 (33.2, 36.5)	63.8 (62.1, 65.5)	55.0 (53.3, 56.7)	34.7 (33.1, 36.4)	26.7 (25.0, 28.3)	62.5 (60.9, 64.2)	63.3 (61.7, 65.0)
Hägglund (2007) [53]	Europe	44.1 (38.3, 49.9)	57.1 (49.9, 64.3)	74.5 (69.9, 79.1)	44.9 (37.6, 52.2)	32.3 (22.2, 42.4)	69.4 (59.3, 79.5)	70.4 (63.8, 77.0)
Azevedo (2008) [25]	Europe	57.8 (55.8, 59.8)	62.5 (60.1, 64.9)	67.0 (64.9, 69.1)	71.8 (69.7, 73.9)	74.6 (72.1, 77.1)	76.5 (74.0, 79.0)	77.9 (75.8, 80.0)
Ramos (2017) [78]	Europe	41.5 (36.3, 46.7)	85.9 (80.7, 91.1)	57.4 (51.7, 63.1)	41.8 (34.7, 48.9)	26.4 (16.7, 36.1)	50.0 (40.3, 59.7)	70.8 (62.8, 78.8)
Sub-group pooled ES		43.1 (35.1, 51.2)	64.7 (59.8, 69.5)	65.1 (59.3, 70.8)	46.5 (33.4, 59.6)	34.6 (15.8, 53.4)	60.6 (53.0, 68.1)	70.9 (65.3, 76.5)
Hatmi (2007) [55]	Asia	50.5 (48.3, 52.7)	42.8 (39.5, 46.1)	56.6 (54.5, 58.7)	39.5 (36.5, 42.5)	21.9 (18.6, 25.2)	21.5 (18.2, 24.8)	43.1 (40.4, 45.8)
AbuRuz (2015) [19]	Asia	51.6 (50.3, 52.9)	33.9 (31.7, 36.1)	53.4 (51.8, 55.0)	42.9 (40.2, 45.6)	43.2 (41.0, 45.4)	45.2 (43.0, 47.4)	45.0 (42.9, 47.1)
Alaloul (2017) [20]	Asia	34.8 (30.9, 38.7)	37.9 (33.6, 42.2)	47.2 (43.8, 50.6)	38.9 (34.2, 43.6)	36.4 (31.6, 41.2)	42.3 (37.5, 47.1)	42.8 (37.8, 47.8)
Sub-group pooled ES		45.9 (38.4, 53.3)	38.1 (32.4, 43.9)	52.6 (48.4, 56.9)	40.8 (38.2, 43.3)	33.8 (19.8, 47.9)	36.3 (20.5, 52.2)	44.2 (42.6, 45.7)
Overall pooled ES		45.8 (41.0, 50.6)	60.1 (52.3, 67.9)	63.0 (58.9, 67.2)	45.5 (39.0, 51.9)	40.5 (14.8, 66.2)	59.2 (41.2, 77.2)	64.8 (57.4, 72.3)

EF [55])

patients to adapt to the disease since men adapted in a shorter time period. This difference can also be due to the different life status and roles played by the two genders since men are more likely to be physically and socially supported than are women. The most commonly used general tool was the SF-36 health survey, which showed that the mean score of the physical component dimension was 33.3 (31.9–34.7), and the mental component dimension was 50.6 (43.8–57.4).

The mean general health dimension was 44.9, which was consistent with previous individual studies on cardiac patients other than those with HF (46.56) [93] and less than in patients with acute coronary artery disease (55.63) [94]. It was also consistent with previous individual studies on other heart diseases in terms of the physical dimension (31.67) [93] and less than in acute coronary artery disease (58.37) [94]. The results also showed that HF patients have a lower QOL in the physical dimension as compared with other chronic patients, such as thalassemic patients (56.78 (52.74–74.5) [95] and in the mental dimension in thalassemic patients (51.64 (59.6–71.1) [95]. Regular QOL measurements can help identify patients with poor QOLs, and help healthcare providers more accurately identify specific dimensions that require more attention. In addition, it can be used as a tool to assess the effect of different treatment interventions on the disease process. It is essential to take into account factors affecting the QOL in HF patients to manage them more effectively and to use effective interventions to improve their QOLs.

According to the International Guideline and ACCF/AHA guideline, considering the multidimensional concept of quality of life, it is necessary to pay attention to the physical and psychological dimensions of patients; the following recommendations can improve the quality of life of patients with heart failure: disease confidence indicates a person's sense of illness that is higher than the individual's dimensions of illness. This feeling improves through self-care. Understanding CHF, due to the different order of occurrence of the symptoms of the disease in different patients of CHF, which makes the disease unique to each individual, it helps the patient to obtain adequate information about the disease. The first step in managing the disease and enhancing the quality of life is to get enough information about the disease. Symptom monitoring, a daily checkup of the most common symptoms of the disease, such as shortness of breath, weight loss, blood pressure changes and coughing, will prevent the patient from becoming acutely ill. Family support, due to the long-term and chronic illness of the patient, family support can lead to improved quality of life for patients [96–98].

Limitations

Although studies included were carried out on patients with varying degrees of disease severity, the QOl score was not expressed in terms of severity and history of disease in most studies; however, it has been shown that the disease severity can have a significant impact on QOl. Attempts were also made to contact with authors of studies lacking relevant information. Most of the studies were descriptive studies, which have their specific limitations.

Strengths

To the best of researchers' knowledge, this is the first study that reviews QOl of HF patients at the global level. In this study, QOl was also assessed based on the geographical area determined by World Health Organization (WHO) and the income level identified by Bank World, which could help health policy-makers and healthcare staffs in the region to help improve QOl more accurately. The present study also assessed the QOl separately using specific and general tools. Another strength of this study was the use of a variety of tools to measure the quality of life in patients with HF.

Conclusion

The present systematic review and meta-analysis were conducted to evaluate the QOL of HF patients. The results showed a moderate to poor QOL in the physical dimension and a moderate to high QOL in the mental dimension using specific and general tools, respectively. The results of the present study, using specific and general tools, indicated the importance of QOL assessment at appropriate time periods, determining the exact treatment dimensions required, and implementing comprehensive QOL promotion programs in all physical and mental dimensions.

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