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The development of self-care skills by heart failure patients using telemonitoring

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Abstract
Telehealth is a rapidly developing aspect of technology use within healthcare, involving the application of health-related services via information technologies. Telemonitoring is a form of telehealth, chosen as the focus of this article because it is increasingly used within healthcare and in the care of heart failure (HF) patients. Telemonitoring is the use of information technology by healthcare professionals to monitor and manage patients' health remotely. Telemonitoring use by HF patients enables them to manage their condition independently, and research indicates that it reduces the mortality rate and hospitalisation of HF patients. This article explores literature regarding HF patients' use of telehealth. A literature review is completed using a thematic analysis approach. Study results are mixed and inconclusive regarding the impact of telemonitoring use on the development of self-care skills in HF patients. However, the findings suggest that HF patients using telemonitoring can develop their knowledge of their condition and find the telemonitoring technology user-friendly. Therefore, a software application (app) is recommended based upon the findings from the literature review, which aims to educate and encourage HF patients using telemonitoring to be able to develop more self-care skills.

Keywords
Heart failure, telemonitoring, self-care, software application

1.1 Introduction
Heart Failure (HF), also known as Chronic Heart Failure (CHF) is a progressive condition that affects the ability of the heart to pump enough blood to different parts of the body due to functional or structural heart abnormalities (National Institute for Health and Care Excellence (NICE), 2018; Ponikowski et al., 2016). Some causes of HF are coronary heart disease (CHD), Valvular Heart Disease (VHD), arrhythmia, cardiomyopathy, and hypertension (Ponikowski et al., 2014). The most common symptoms of HF are breathlessness, fatigue, and swelling of the lower extremities, known as oedema (Lee, Moser & Dracaup, 2018).

Globally, over 37.7 million people have HF (Ziaeian & Fonarow, 2016). In the United Kingdom (UK), approximately 920,000 individuals have HF (British Heart Foundation (BHF), 2020; NICE, 2018). In England, over 550,000 individuals have been diagnosed

with HF (BHF, 2020). The prevalence of HF continues to rise due to people living prolonged lives (Inglis, Clark, Dierckx, Prieto-Merino & Cleland, 2015; NICE, 2018), as well as an increase in the number of people that are obese (NICE, 2018).

Telehealth is an evolving aspect of the healthcare system that involves the use of information technology to provide healthcare services to patients remotely (Eurlings, Boyne, de Boer & Rocca, 2019). Telemonitoring is a form of telehealth, chosen as the focus of this article because it is increasingly used within healthcare and in the management of HF patients (Brahmbhatt & Cowie, 2019). Telemonitoring is the use of information technology by healthcare professionals to monitor and manage the condition of patients remotely (Brahmbhatt & Cowie, 2019; Meystre, 2005). A Cochrane review by Inglis et al (2015) identified that the use of telemonitoring by HF patients reduces mortality rate and hospitalisation, and this is because it results in early recognition of deterioration in HF patients and therefore, leads to prompt intervention and treatment (Koehler et al., 2018; Maeng et al., 2014). Telemonitoring enables HF patients to be better equipped to manage their health independently, resulting in a better quality of life for HF patients (Inglis et al., 2015).

This article explores the literature regarding telehealth use in HF patients. The objectives are: (1) To investigate telemonitoring use in HF patients (2) To evaluate the impact of telemonitoring on HF patients' knowledge of their condition and their self-care skills. A literature review strategy will be presented, including search methods, and key literature will be critically appraised to establish the latest evidence-based research regarding the use of telemonitoring in HF patients. Key themes will be identified for further exploration in this session, and these themes are HF patients using telemonitoring technology, HF patients' knowledge of their condition and self-care in HF patients. An app will be recommended to address some of the issues arising from the literature review.

2.1 Literature review

A systematic search strategy was employed to ensure a thorough search of the relevant literature to be reviewed based on the research question: can telemonitoring use in HF patients lead to effective self-care? Information from grey literature, google scholar and trip database was obtained to achieve a better understanding of the research question. Clinical networking with relevant practitioners and experts in the field enhanced awareness of the project topic.

2.2 Search Strategy

Cumulative Index of Nursing and Allied Health Literature (CINAHL) and Medical Literature Analysis and Retrieval System Online (MEDLINE) were the electronic databases used in searching for the articles. CINAHL and MEDLINE were used because they both contain a broad spectrum of nursing articles (Aveyard, 2019). The Population Intervention Comparison Outcome (PICO) tool was used as a guide in the formation of the research question, and in the literature search to ensure a more focused search (Aslam & Emmanuel, 2010). Methley, Campbell, Chew-Graham, McNally and Cheraghi-Sohi (2014) recommends the use of the PICO tool when undertaking a thorough and systematic search. CINAHL subheadings and MeSH

(Medical Subject Headings) were used, and the keywords identified were inserted into the CINAHL subheadings and MeSH. The keywords used were heart failure, telehealth, telenursing, telemonitoring, telemedicine, self-care, and self-management. At the start of the literature search, telehealth was used. However, after reading some of the articles, amendments were made due to various terminologies for telehealth. All nomenclatures for telehealth were used to reduce the risk of missing out relevant literature. Boolean operators (AND & OR) were successfully used to combine keywords and find the articles used.

The inclusion criteria were English Language, peer-reviewed, articles published from 2010 to 2020 and focused on patients aged 65 plus years. Inglis et al (2015) and NICE (2018) state that HF is more prevalent in older adults; therefore, the age of 65 plus years was used. The exclusion criteria were pilot studies, articles not specific to HF patients, telemonitoring and self-care, articles that are not research papers, and systematic reviews that were published before 2017. Whitlock, Lin, Chou, Shekelle and Robinson (2008) suggest that systematic reviews become outdated in about three to five years, or less after it has been published (as cited in Aveyard, 2019, p. 113). Pilot studies were excluded because they are not actual research studies. Pilot studies are done to try-out the data collection method and design to be used for the actual research (Kane and Barker, 2019; Lacey, 2015).

Limiters (inclusion criteria) were used, and as a result, fifty articles were retrieved. The titles and abstracts of the fifty articles retrieved from the final search were read to choose the most pertinent articles to review based on the exclusion criteria. Three duplicates were removed, and six articles were chosen. Ortega and Barker (2019) state that the titles and abstracts of each article obtained must be read to choose the most pertinent articles that will answer the research question. International articles written in the English language were included in the literature review to prevent excluding articles that are relevant to the research question. The international articles included had similar healthcare settings with that of the UK, thereby ensuring transferability.

Some of the limitations encountered during the literature search were the limited number of articles present when the full-text limit was added; therefore, it could not be used. Also, there was no access to some of the articles, as these articles could only be accessed by paying for them, which was not feasible for this study. Therefore, this may have affected both the comprehensiveness of the search strategy and ultimately, the ability to make an absolute judgment on the research question. Lack of fluency in other languages, except the English Language led to excluding articles not written in the English Language. This may have resulted in useful studies being excluded from the review.

2.3 Findings

Braun and Clarke's (2006) thematic analysis framework was used to identify the main themes from the articles retrieved. Braun and Clarke (2006) and Aveyard (2019) state that the thematic analysis approach is easy to use, especially for novice researchers. The most predominant themes identified within the literature reviewed are HF patients using telemonitoring technology, HF patients' knowledge of their condition and self-care in HF patients. The Critical Appraisal Skills Programme (CASP) tools were used to critique all the articles identified for the literature review (CASP, 2018). CASP tools are easy to apply, concise and available for various study designs (Nadelson & Nadelson, 2014). Two Randomised Control Trials (RCTs), one prospective, quasi-experimental study, one longitudinal study, and two qualitative studies were critiqued

for methodological quality. The range of methodologies suggested that a comprehensive appreciation of the topic area might be possible. In figure 1, an extraction table consisting of a summary of the findings from the articles used in this literature review and other attributes of each article used was included. The themes identified are elaborated on below.

2.3.1 HF patients using telemonitoring technology

Fairbrother et al (2014) conducted a qualitative study to explore the perception of CHF patients and healthcare professionals on the use of telemonitoring and the identified advantages of telemonitoring when managing CHF. Semi-constructed interviews took place, and topic guides were used for the interviews. Eighteen patients and five healthcare professionals were interviewed. Patients state that the telemonitoring technology is user-friendly (Fairbrother et al., 2014). Also, Fairbrother et al (2014) observed that patients are active and compliant in using the technology. Data saturation occurred at eighteen patients, and if done appropriately, data saturation can be used to ensure that quality data are collected (Walker, 2012).

Jaana, Sherrard and Pare (2019) report that patients find the telemonitoring technology user-friendly. Patients receive support from family members, friends, and nurses on the use of the technology and patients' desire to use the technology are high (Jaana et al., 2019). Jaana et al (2019) did a longitudinal study to measure empowerment, self-care, and adoption factors in elderly patients with CHF. Twenty-three patients were included in the study, and the study was for six months. When the sample size of quantitative research is small, it could affect the external validity of the research, and as a result, affect the ability of the findings to be generalised to a larger population (Barker, Kane & Nelson, 2019; Sutherland, 2017).

Riley, Gabe, and Cowie (2013) performed a qualitative study to explore to what degree can telemonitoring empower HF patients to self-care. The study was for six months, and fifteen patients were included in the study. Semi-constructed interviews were conducted, and the interviews were transcribed and audiotaped. Thematic analysis was used to derive the themes for the study, and it was clear how this occurred. Riley et al (2013) report that all patients involved in the study engaged with the telemonitoring technology daily. Patients with comorbidities that affect their physical functioning, for example, Parkinson's disease, develop strategies to use the telemonitoring technology, and they have support from their family members as required (Riley et al., 2013).

2.3.2 HF patients' knowledge of their condition

Boyne et al (2014) report that there is a significant increase in patients' knowledge of their condition in the telemonitoring group (p<0.001) after twelve months. In the usual group, there is an increase in their knowledge level but not a significant increase (Boyne et al., 2014). Riley et al (2013) report that patients can develop their knowledge of their HF condition over six months of using telemonitoring.

de Oliveira, Cordeiro, Rocha, Guimaraes and de Albuquerque (2017) performed an RCT that measured the correlation between knowledge and self-care in HF patients that used telephone-based monitoring, and the study was for four months. The study contained a sample size of thirty-six patients who were randomised into two groups: nineteen patients in the intervention group and seventeen patients in the control group. In the intervention group, there is a significant increase in patients' knowledge in the second and fourth month (p=0.001). In the control group, there is an increase in patients' knowledge in the second month, but the increase is not maintained in the

fourth month, and no explanation is offered by the researchers on this (de Oliveira et al., 2017). The CONSORT 2010 checklist was used; however, the CONSORT flow chart was not used. The CONSORT statement consists of the CONSORT checklist and the flow diagram (Aveyard, 2019). The CONSORT statement guides researchers to report RCTs thoroughly and transparently (Schulz, Altman & Moher, 2011).

Fairbrother et al (2014) report that patients observed an improvement in their knowledge and understanding of their condition by using telemonitoring. Jaana et al (2019) find that after three months of using telemonitoring, patients' knowledge of their condition slightly increased. Surprisingly, this increase is not maintained in the sixth month (Jaana et al., 2019). Interestingly, de Oliveira et al (2017) observe that there is a significant negative correlation between self-care and knowledge in the intervention group in the 2nd month (r= -0.48, p= 0.03). This suggests that as patients' self-care skills increases, patients' knowledge of their condition will decrease and vice versa. This negative correlation is maintained in the 4th month (r= -0.37, p=0.11). These findings are worthy of consideration when designing an improvement tool to meet the needs of this patient group.

2.3.3 Self-care in HF patients

This theme aims to critically analyse the effect of telemonitoring on self-care in HF patients. The term self-care consists of two components: self-care maintenance and self-care management (Riegel, Lee, Dickson & Carlson, 2009; Riegel, Lee & Dickson, 2011). Self-care skills can be defined as patients being able to make the right decisions when their symptoms worsen (self-care management) and being able to maintain a healthy lifestyle and adhere to treatment (self-care maintenance) (Riegel et al., 2009).

Evangelista et al (2015) conducted a prospective, quasi-experimental study to measure the outcome of Remote Monitoring Systems (RMS) on self-care, activation, and quality of life in elderly CHF patients for three months. As a result of non-randomisation in this type of study, their findings are considerably weaker than RCTs due to threats to the study's internal validity (Sutherland, 2017). Forty-two patients were included in this study by using convenience sampling: twenty-one patients in the RMS group and twenty-one patients in the comparison group.

Evangelista et al (2015) report that patients in both groups experienced an increase in their self-care management levels. However, in the RMS group, there is a significant increase in patients' self-care management levels (p value <0.001). Significant p-values are p<0.05, p<0.01 and p<0.001 (Moule, 2018). In the RMS group, there is an increase in their self-care maintenance levels, but in the comparison group, a decrease occurs (Evangelista et al., 2015). It is observed that there is a significant positive correlation between self-care management and self-care maintenance (r= 0.594, p<0.001). This means that as patients' self-care management level increases, their self-care maintenance level also increases, and vice versa (Evangelista et al., 2015).

Jaana et al (2019) state that overall, telemonitoring did not lead to an improvement in patients' self-care maintenance levels. There is an overall increase in patients' self-care management levels except on some measures. The measures are the ability for patients to recognise early that breathlessness and ankle swelling are HF symptoms, to take an extra diuretic or call doctors and nurses for advice, and lack of confidence to whether the use of remedies would be helpful (Jaana et al., 2019). All these imply that there is a need for patient education to be focused on self-care in HF patients that are using telemonitoring (Jaana et al., 2019).

After six months of using telemonitoring, most of the patients can identify when a significant change has occurred in their vital signs, and they can communicate this to the telemonitoring nurse for support and guidance (Riley et al., 2013). However, these patients are not able to make their own decisions based on the changes in their vital signs. Patients are provided with basic education on heart failure (Riley et al., 2013), and this could be the reason why patients are unable to develop their self-care skills effectively. It is evident from the findings that these patients would need to be educated more specifically on self-care when using telemonitoring. After the 12th month of the trial, patients in the telemonitoring group experience a significant increase (p<0.001) in their self-care skills, and patients in the usual care group did not experience an increase in their self-care skills (Boyne et al., 2014).

Fairbrother et al (2014) report that patients are unable to self-manage their condition even with prompts from healthcare professionals, as they relied on healthcare professionals in the management of their condition. The healthcare professionals perceived that this could be because of the telemonitoring system's daily patient questions, as it was more controlling by telling patients what to do at a specific time instead of prompting them (Fairbrother et al., 2014). This suggest that telemonitoring technologies and systems need to be developed in a way that promotes self-care in patients. The healthcare professionals state that there is a need for patients and healthcare professionals using telemonitoring in patient care to be educated and trained on self-management, but this did not occur in this study (Fairbrother et al., 2014). de Oliveira et al (2017) found that in the intervention group, there is a significant increase in HF patients' self-care skills in the second and fourth month (p=0.001). However, a significant increase did not occur in the control group regarding their self-care skills.

In conclusion, patients find the telemonitoring technology user-friendly (Fairbrother et al., 2014; Jaana et al., 2019; Riley et al., 2013). The use of telemonitoring led to an increase in patients' knowledge of their condition (Boyne et al., 2014; de Oliveira et al., 2017; Fairbrother et al., 2014; Jaana et al., 2019). Most of the findings report that the use of telemonitoring increased patients' self-care skills (Boyne et al., 2014; de Oliveira et al., 2017; Evangelista et al., 2015; Jaana et al., 2019; Riley et al., 2013). However, from these findings, some aspects of patients' self-care skills are not influenced by telemonitoring. Interestingly, Fairbrother et al (2014) find that patients in this study, are unable to develop their self-care skills while using telemonitoring. The overall methodological quality of the literature is good, which enhanced the ability to use the research findings to inform the development of the chosen recommendation.

3.1 Recommendations

From the literature review, the most encountered issue identified from the findings is that telemonitoring demonstrated limited impact upon HF patients' development of self-care skills, indicating this as a significant aspect for further development. From the literature review, Fairbrother et al (2014) and Jaana et al (2019) suggest that there is a need for HF patients using telemonitoring to be educated on self-care for them to develop more self-care skills. Delaney et al (2013) reported that when HF patients use telemonitoring and are educated on self-care, it leads to an increase in their knowledge of self-care. This results in patients developing more self-care skills, and it leads to better health outcomes (Hart & Nutt, 2020). Suggesting that education is key for the effective use of telemonitoring. Therefore, an educational package is recommended to HF patients using telemonitoring that is focused on self-care.

The mediums considered are an app, website, narrated PowerPoint, podcast, and e-learning. An app is chosen as the most appropriate delivery format for the following reasons. HF patients can access the content of the app anytime and in any location, they want, thereby, enabling HF patients to be in control of their learning (Win, Hassan, Bonney & Iverson, 2015). The app will promote audio-visual learning for HF patients. When audio-visual learning is initiated for use in a learning resource, it activates the visual and auditory senses of learners (Rasul et al., 2011). When this occurs, it facilitates the interest and engagement of the learners, and as a result, leads to learners learning more, understanding better and retaining the content of the learning resource (Goad, Huntley-Dale & Whichello, 2018). The affordances of such an app indicate that the value for further research and development, of which this research is just the beginning.

4.1 Conclusion

From the findings, it is identified that HF patients did find the telemonitoring technology easy to use, resulting in an increase in their knowledge of their condition. Most of the findings report that HF patients can develop their self-care skills but not effectively. Only one of the findings report that HF patients are unable to develop their self-care skills while using telemonitoring. The findings from the literature review led to the recommendation of an app to address the gaps and issues identified. This app will educate HF patients using telemonitoring on how they can develop more self-care skills, resulting in improved health outcomes for almost a million UK residents.

In the event of writing this article, the Covid-19 pandemic evolved, which subsequently influenced the use of telehealth worldwide. Consequently, future research might demonstrate greater acceptance and application of these technologies in this patient group. Additionally, further research is needed in understanding the perception of nurses on telehealth use by HF patients as there is limited research on this topic area, and this may enhance the positive outcomes even further.

Conflict of Interest

None

Reference List

Aslam, S., & Emmanuel, P. (2010). 'Formulating a researchable question: A critical step for facilitating good clinical research'. *Indian Journal of Sexually Transmitted Diseases and AIDS*. 31(1), pp.47-50. doi: 10.4103/2589-0557.69003.

Aveyard, H. (2019). *Doing a literature review in health and social care: A practical guide*. 4th ed. London: Open University Press.

Barker, J., Kane, R., & Nelson, D. (2019). 'Critical appraisal and quantitative research', in Linsey, P., Kane, R., & Barker, J. (eds.). *Evidence-based practice for nurses and healthcare professionals.* 4th ed. London: SAGE, pp.108-122.

Boyne, J.J.J., Vrijhoef, H.J.M., Spreeuwenberg, M., De Weerd, G., Kragten, J., & Gorgels, A.P.M. (2014). 'Effects of tailored telemonitoring on heart failure patients' knowledge, self-care, self-efficacy, and adherence: A randomised controlled trial'. *European Journal of Cardiovascular Nursing.* 13(3), pp.243-252.

Brahmbhatt, D.H., & Cowie, M.R. (2019). 'Remote management of heart failure: An overview of telemonitoring technologies'. *Cardiac Failure Review*. 5(2), pp.86-92.

Braun, V., & Clarke, V. (2006). 'Using thematic analysis in psychology'. *Qualitative Research in Psychology*. 3(2), pp.77-101.

British Heart Foundation. (2020). *England Factsheet*. London: BHF. Available at: https://www.bhf.org.uk/what-we-do/our-research/heart-statistics (Accessed: 28 January 2020).

British Heart Foundation. (2020). *UK Factsheet*. London: BHF. Available at: https://www.bhf.org.uk/what-we-do/our-research/heart-statistics (Accessed: 28 January 2020).

Critical Appraisal Skills Programme. (2018). *CASP Checklist.* Oxford: CASP. Available at: https://casp-uk.net/casp-tools-checklists/ (Accessed: 7 March 2020).

de Oliveira, J.A., Cordeiro, R.G., Rocha, R.G., Guimarães, T.C.F., & de Albuquerque, D.C. (2017). 'Impact of telephone monitoring on patients with heart failure: A randomised clinical trial'. *Acta Paulista de Enfermagem*. 30(4), pp.333-342.

Delaney, C., Apostolidis, B., Bartos, S., Morrison, H., Smith, L., & Fortinsky, R. (2013). 'A randomised trial of telemonitoring and self-care education in heart failure patients following home care discharge'. *Home Health Care Management & Practice*. 25(5), pp.187-195.

Eurlings, C.G.M.J., Boyne, J.J., de Boer, R.A., & Rocca, H.P.B. (2019). 'Telemedicine in heart failure - more than nice to have?' *Netherlands Heart Journal*. 27, pp.5-15.

Evangelista, L.S., Lee, J., Moore, A. A., Motie, M., Ghasemzadeh, H., Sarrafzadeh, M., & Mangione, C.M. (2015). 'Examining the effects of remote monitoring systems on activation, self-care, and quality of life in older patients with chronic heart failure'. *Journal of Cardiovascular Nursing.* 30(1), pp.51-57.

Fairbrother, P., Ure, J., Hanley, J., McCloughan, L., Denvir, M., Sheikh, A., & McKinstry, B. (2014). 'Telemonitoring for chronic heart failure: The views of patients and healthcare professionals - a qualitative study'. *Journal of Clinical Nursing (John Wiley & Sons, Inc.).* 23(1-2), pp.132-144.

Goad, M., Huntley-Dale, S., & Whichello, R. (2018). 'The use of audiovisual aids for patient education in the interventional radiology ambulatory setting: A literature review'. *Journal of Radiology Nursing*. 37(3), pp.198–201.

Hart, J., & Nutt, R. (2020). 'Improving inpatient education and follow-up in patients with heart failure: A hospital-based quality improvement project'. *Nursing Economic$*. 38(2), pp.74-85.

Inglis, S.C., Clark, R.A., Dierckx, R., Prieto-Merino, D., & Cleland, J.G.F. (2015). 'Structured telephone support or non-invasive telemonitoring for patients with heart failure (Review)'. *Cochrane Database of Systematic Reviews*. 10, pp.1-205.

Jaana, M., Sherrard, H., & Paré, G. (2019). 'A prospective evaluation of telemonitoring use by seniors with chronic heart failure: Adoption, self-care, and empowerment'. *Health Informatics Journal*. 25(4), pp.1800-1814.

Kane, R., & Barker, J. (2019). 'What is critical appraisal?', in Linsey, P., Kane, R., & Barker, J. (eds.). *Evidence-based practice for nurses and healthcare professionals*. London: SAGE, pp. 93-107.

Koehler, F., Koehler, K., Deckwart, O., Prescher, S., Wegscheider, K., Winkler, S., Vettorazzi, E., Polze, A., Stangl, K., Hartmann, O., Marx, A., Neuhaus, P., Scherf, M., Kirwan, B., & Anker, S.D. (2018). 'Telemedical interventional management in heart failure II (TIM-HF2), a randomised, controlled trial investigating the impact of telemedicine on unplanned cardiovascular hospitalisations and mortality in heart failure patients: Study design and description of the intervention'. *European Journal of Heart Failure*. 20(10), pp.1485–1493.

Lacey, A. (2015). 'The research process', in Gerrish, K., & Lathlean, J. (eds.). *The research process in nursing.* 7th ed. Chichester: John Wiley & Sons, Ltd, pp.15-29.

Lee, K.S., Moser, D.K., & Dracup, K. (2018). 'Relationship between self-care and comprehensive understanding of heart failure and its signs and symptoms'. *European Journal of Cardiovascular Nursing*. 17(6), pp.496-504

Maeng, D.D., Starr, A.E., Tomcavage, J.F., Sciandra, J., Salek, D., & Griffith, D. (2014). 'Can telemonitoring reduce hospitalisation and cost of care? A health plan's experience in managing patients with heart failure'. *Population Health Management*. 17(6), pp.340-344.

Methley, A.M., Campbell, S., Chew-Graham, C., McNally, R., & Cheraghi-Sohi, S. (2014). 'PICO, PICOS and SPIDER: A comparison study of specificity and sensitivity in three search tools for qualitative systematic reviews'. *BMC Health Services Research*. 14 (579), pp.1-10.

Meystre, S. (2005). 'The current state of telemonitoring: A comment on the literature'. *Telemedicine Journal and E-Health: The Official Journal of the American Telemedicine Association*. 11(1), pp.63-69.

Moule, P. (2018). *Making sense of research in nursing, health and social care.* 6th ed. London: SAGE.

Nadelson, S., & Nadelson, L.S. (2014). 'Evidence-based practice article reviews using CASP tools: A method for teaching ESP'. *Worldviews on Evidence-Based Nursing.* 11(5), pp.344-346.

National Institute for Health and Care Excellence. (2018). *Chronic heart failure in adults: Diagnosis and management.* Available at: https://www.nice.org.uk/guidance/ng106 (Accessed: 6 December 2019).

Ortega, M. & Barker, J. (2019). 'Finding the evidence', in Linsey, P., Kane, R., & Barker, J. (eds.). *Evidence-based practice for nurses and healthcare professionals.* 4th ed. London: SAGE, pp.66-88.

Ponikowski, P., Anker, S.D., AlHabab, K.F., Cowie, M.R., Force, T.L., Hu, S., Jaarsma, T., Krum, H., Rastogi, V., Rohde, L.E., Samal, U.C., Shimokawa, H., Siswanto, B.B., Sliwa, K., & Flippatos, G. (2014). 'Heart failure: Preventing disease and death worldwide'. *ESC Heart Failure*. 1, pp.4-25.

Ponikowski, P., Voors, A.A., Anker, S.D., Bueno, H., Cleland, J.G.F., Coats, A.J.S., Falk, V., Gonzalez-Juanatey, J.R., Harjola, V.-P., Jankowska, E.A., Jessup, M., Linde, C., Nihoyannopoulos, P., Parissis, J.T., Pieske, B., Riley, J.P., Rosano, G.M.C.,

Ruilope, L.M., Ruschitzka, F., Rutten, F.H., & van der Meer, P. (2016). '2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure'. *European Heart Journal.* 37(27), pp.2129-2200.

Rasul, S., Bukhsh, Q., & Batool, S. (2011). 'A study to analyse the effectiveness of audio visual aids in teaching learning process at university level'. *Procedia- Social and Behavioural Sciences.* 28, pp.78-81.

Riegel, B., Lee, C.S., & Dickson, V.V. (2011). 'Self care in patients with chronic heart failure'. *Nature Reviews Cardiology.* 8, pp.644-654.

Riegel, B., Lee, C.S., Dickson, V.V., & Carlson, B. (2009). 'An update on the self-care of heart failure index'. *Journal of cardiovascular nursing.* 24(6), pp.485-497.

Riley, J.P., Gabe, J.P.N., & Cowie, M.R. (2013). 'Does telemonitoring in heart failure empower patients for self-care? A qualitative study'. *Journal of Clinical Nursing (John Wiley & Sons, Inc.).* 22(17-18), pp.2444-2455.

Schulz, K.F., Altman, D.G., & Moher, D. (2011). 'CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials'. *International Journal of Surgery.* 9(8), pp.672–677.

Sutherland, S. (2017). 'Quantitative methodology: Interventional designs and methods', in Gray, J.R., Grove, S.K., & Sutherland, S. (eds.). *Burns and Grove's the practice of nursing research: Appraisal, synthesis, and generation of evidence.* 8th ed. Missouri: Elsevier, pp. 217-250.

Walker, J.L. (2012). 'The use of saturation in qualitative research'. *Canadian Journal of Cardiovascular Nursing.* 22(2), pp.37–41.

Win, K.T., Hassan, N.M., Bonney, A., & Iverson, D. (2015). 'Benefits of online health education: Perception from customers and health professionals'. *Journal of Medical Systems.* 39(3), pp.1-13.

Ziaeian, B., & Fonarow, G.C. (2016). 'Epidemiology and aetiology of heart failure'. *Nat Rev Cardiol.* 13(6), pp.368-378.

Figure
Figure 1: Data extraction table

Author Date	Country	Population Sample size	Design	Outcome measures	Themes	Findings
Jaana et al (2019)	Canada	Elderly patients with CHF. N=23	Longitudinal study	Patient empowerment, self-care and adoption factors in elderly CHF patients using telemonitoring.	Patient empowerment and self-care. Adoption factors and health consciousness.	Patients found the telemonitoring technology user-friendly. There was an increase in patients' knowledge after three months of using the system, however, this was not maintained in the sixth month. Patients' self-care maintenance levels were not influenced by using telemonitoring. There was an overall increase in patients' self-care management levels except on some measures.
Riley et al (2013)	UK	HF patients. 60% of these patients are symptomatic when performing moderate activities, and 40% of these patients are symptomatic when performing mild activities. N=15	Qualitative study	To what degree can telemonitoring empower HF patients to self-care?	The experience of symptoms, use of the technology, HF self-care maintenance, and HF self-care management.	It was observed that despite patients having comorbidities that affected their physical ability, these patients developed tactics to be able to use the telemonitoring technology. Patients gained more knowledge of their HF condition over the period of using the telemonitoring technology. Patients were able to develop their self-care skills in some areas over time.
Boyne et al (2014)	The Netherlands	HF patients with a New York Heart Association (NYHA) classification from II-IV. N=382	RCT	Knowledge, self-care, self-efficacy, and adherence in HF patients.	Effect on disease-specific knowledge, effect on self-care, effect on self-efficacy, effect on adherence, and adherence of using the telemonitoring system.	Overall, 90% of the patients in the telemonitoring group used the telemonitoring system daily. There was a significant increase in patients' knowledge of their condition in the telemonitoring group, but in the

						usual care group, patients did not experience a significant increase in their knowledge levels. Also, there was a significant increase in patients' self-care skills in the telemonitoring group, but there were no changes in the usual care group. Telemonitoring had an influence on fluid restriction, weighing, medication adherence and physical activities. However, telemonitoring use did not influence smoking, alcohol consumption, appointments, and a salt restricted diet.
Fairbrother et al (2014)	UK	CHF patients and healthcare professionals. N=23 18 CHF patients and 5 healthcare professionals.	Qualitative study	The perception of CHF patients and healthcare professionals on the use of telemonitoring in the management of CHF.	Information, support and reassurance, compliance, and dependence, changes and challenges, determining the criteria for patient applicability to telemonitoring, and continuity of care.	Patients found the telemonitoring technology user-friendly. Patients stated that there was an increase in their knowledge of their condition by using the telemonitoring. Patients were unable to develop their self-care skills. They relied on healthcare professionals to manage their condition. Professionals stated that adding telemonitoring to their normal workload was too intense for them, and it was time consuming.
de Oliveira et al (2017)	Brazil	HF patients. N=36	RCT	The correlation between knowledge and self-care.	Knowledge and self-care.	There was a significant increase in patients' knowledge in the intervention group. In the usual care group, there was an increase in

						patients' knowledge. In the intervention group, there was a significant increase in patients' self-care skills. However, in the usual care group, a significant increase did not occur. In the second month, it was observed that there was a significant negative correlation between self-care and knowledge in the intervention group (r= -0.48, p= 0.03).
Evangelista et al (2015)	USA	Elderly patients with CHF. N=42	Prospective, quasi-experimental study	The influence of RMS on activation, self-care, and quality of life (QOL) in elderly CHF patients.	Activation, Self-care and QOL.	Patients in the RMS group experienced a significant increase in their self-care management levels. In the comparison group, there was an increase in patients' self-care management levels, but it was not a significant increase. Also, there was an increase in patients' self-care maintenance levels in the RMS group, however, a decreased occurred in the comparison group. There was a significant positive correlation between self-care management and self-care maintenance (r= 0.594, p < 0.001).