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Utilizing Telehealth to Decrease Hospital Readmissions for Heart Failure Patients

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Abstract

Background: Without proper education, heart failure (HF) is very difficult to manage. A lack of education and proper management of HF can lead to frequent hospital readmissions, decreased quality of life, and early morbidity and mortality.

Objective: Through literature review, this paper aims to identify the benefits of implementing telehealth education for HF patients in order to decrease hospital readmissions.

Methods: A range of relevant articles were analyzed and summarized in this literature review. An extensive literature search was performed and systematic reviews, meta-analyses, critically appraised research studies, qualitative, and peer-reviewed research studies were included.

Results: Ten articles met the requirements. Based on the literature, most studies favor the use of telehealth outpatient education, noticing a decrease in frequency of hospital readmissions, an increase in quality of life, and decreased healthcare cost.

Conclusion: Based on the literature, telehealth is recommended to manage HF and educate patients in the outpatient setting.

Implications for Nursing: Telehealth can be a simple, low cost, effective way to decrease HF readmissions. Future research should focus on the best way to implement telehealth and to consider other factors such as patient comorbidities.

Key Words: *heart failure (HF), education, telehealth, readmission*

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Utilizing Telehealth to Decrease Hospital Readmissions for Heart Failure Patients

Heart failure (HF) is a chronic condition in which the heart muscle weakens and cannot pump blood effectively. It is a very difficult disease to manage. It requires knowledge and maintenance of medication regimen, exercise, weight management, nutrition, and fluid intake. Within one month after discharge, 20-30% of patients with HF will be readmitted, and within six months, 50% of patients will be readmitted (Pandor et al., 2013). HF hospitalization makes up two percent of annual healthcare costs in the United States (US) (Garcia et al., 2019). There are over 800,000 new cases of HF every year in the US (Hart & Nutt, 2020). With technology now in nearly everyone's lives, telehealth and telemedicine have been increasing in popularity. Telehealth is a way of giving health-related services, such as healthcare appointments, via telephone or video call. The patient speaks with a healthcare provider live but is not physically in the room with them. A majority of hospitals do not have HF outpatient programs, and only a few hospitals have programs which follow up with HF patients one time shortly after discharge.

A majority of hospitals have in-person follow up appointments only, and do not utilize telehealth. This practice is not sufficient to provide the education and support that HF patients need to manage their disease on their own. The PICOT question addressed is *in adult patients with heart failure, how does telehealth education compared with usual care affect hospital readmission rates within thirty days after hospital discharge?* The purpose of this paper is to explore the effectiveness of implementing telehealth to the HF population to help decrease hospital readmissions, thus decreasing cost and leading to a higher quality of life for patients.

Search Methodology

In order to search for relevant research, many combinations of the key words *heart failure, readmi*, tele*, teach, and educat** were used. Databases used include CINAHL, PubMed, SCOPUS, and Cochrane. Publications included in the search were systematic reviews, meta-analyses, critically appraised research studies, qualitative, and peer-reviewed research studies. Limitations to the search were that each article had to be written in English, include participants eighteen years or older, and be published after 2015. This way only the most relevant, up to date research is used. Search results yielded between 57-256 results depending on the database and key words used. Keywords *heart failure* AND *readmi** yielded 256 results, *heart failure* AND *tele* yielded 104 results, and *heart failure AND educat* AND tele** yielded 57 results. Data was narrowed down based on the relevance to the PICOT question, location, and quality of research. A total of ten articles were reviewed. Many articles used a much longer length of intervention or measurement than my proposed project, and did not look at readmission rates, which narrowed down the search much more. Most studies found took place in the US or Europe, with a few taking place in Asia and Africa. Articles taking place in the US, and specifically California are the most relevant to this literature review as future groundwork will be held in California.

Integrated Review of Literature

Hospital Readmissions

Implementing telehealth has led to a decrease in hospital readmissions for HF patients. Blum and Gottlieb (2014) performed a randomized control trial (RCT) to analyze Medicare claims data and evaluate costs, mortality, health-related quality of life, and 30-day readmission rates between people using telemonitoring versus usual care. Usual care given to patients after discharge included one in-person follow up visit within four days. For the

intervention these patients had performed daily monitoring of their weight, heart rate, blood pressure, and heart rhythm as well as worked with a nurse practitioner (NP) via telephone (Blum & Gottlieb, 2014). They found significant results showing that there were less hospital readmissions for the intervention group ($p<0.05$) (Blum & Gottlieb, 2014). A study by Bernocchi et al. (2017) found similar results. This study was an RCT as well and used a nurse and physical therapist to perform the telehealth education for two months (Bernocchi et al., 2017). They found significant results showing the time to readmission was less for the intervention group, indicating that patients had decreased readmission rates and were able to stay at home for longer periods of time ($p=0.048$). A study by Ong et al. (2016) also performed a RCT, but found mixed results. This large study in California measured hospital readmission rates at 30 and 180-days post-intervention (Ong et al., 2016). They did not find significant differences for the 30 and 180-day readmission rates ($p=0.74$, $p=0.56$ respectively), but did find significant results showing that 30-day mortality decreased for the intervention group ($p=0.04$) (Ong et al., 2016).

Similarly, a study by Long (2017) performed a systematic review of 30-day readmission and mortality rates for HF patients and found mixed results. They found that while mortality rates decreased by 50%, readmissions only decreased by 2% (Long, 2017). Woodside et al. (2011) looked at readmission rates for people in rural northern Michigan. They implemented telehealth and telerehabilitation via a nurse and found significant results. Readmission rates decreased by 2.9% in 2007, 2.5% in 2008, and 2.23% in 2009 (Woodside et al., 2011). Another systematic review by Garcia et al. (2019), looked at previous RCTs and the difference between studies that supported and discouraged telehealth. They found that articles supporting telehealth and showing fewer readmissions were privately funded, had more structured interventions such

as a more structured telephone call, and the intervention lasted approximately nine months, as opposed to twelve months for the studies discouraging telehealth (Garcia et al., 2019). Kasper et al. (2002) performed telehealth and in-person education to reduce readmissions and cost and found significant results. Patients had fewer readmissions ($p=0.09$), deaths ($p=0.03$), better diets ($p=0.02$), and medication compliance ($p<0.001$) (Kasper et al., 2002). Slightly different from the other studies mentioned is a qualitative study by Durante et al. (2019), which was a convenience sample looking at caregiver's perspectives on caring for HF patients. They found that caregivers often got advice from friends, family, and neighbors, not healthcare professionals, and they had trouble implementing interventions and managing symptoms (Durante et al., 2019). Similar to the other studies analyzed, the providers focused most on medication management, diet and exercise, and found that many of the caregivers were uneducated on these aspects of care (Durante et al., 2019). This lack of proper education is a huge barrier and reason that influences the amount of hospital readmissions.

Quality of Life

One benefit of having decreased hospital readmissions is to have better quality of life for HF patients. Blum and Gottlieb (2014) found significant results ($p<0.001$) showing that quality of life was increased for patients using home telemonitoring, whether or not hospital readmissions decreased. Grustam et al. (2018) researched the change in quality adjusted life years (QALY) between usual care, home telemonitoring (HTM), and nurse telephone support (NTS). They found that people who used HTM and NTS gained 2.93 and 3.07 QALYs respectively (Grustam et al., 2018). Ong et al. (2016) also examined the quality of life of patients 180-days post the start of the intervention or usual care and found significant results showing that the intervention group reported a higher quality of life ($p=0.02$). These articles

show that people are willing to pay a little bit more and do the extra work at home to have an increased quality of life.

Evidence Appraisal

Each of these articles is ranked a Level I based on the Johns Hopkins Evidence-Based Research Appraisal Tool (2018) because they are either systematic reviews or RCT's except the article by Woodside et al. (2011). That article scored a level II due to it being a quasi-experimental study (Woodside et al., 2011). Each article sored Quality A based on the Johns Hopkins Evidence-Based Research Appraisal Tool (2018) except for the study by Blum and Gottlieb (2014) and Woodside et al. (2011). The articles that scored Quality A provided detailed content, methods, analysis, conclusion, limitation, and recommendation sections. The studies by Blum and Gottlieb (2014) and Woodside et al. (2011) are Quality B because they provide detailed analysis, methods, conclusion, limitations, but do not discuss recommendations. The study by Durante et al. (2019) ranked a Level III because it was done independently from other studies, is not a literature review or meta-analysis, and involves no quantitative research.

Relevance of Data

Each of these articles provides high quality, relevant data to examine the benefits of telehealth on readmissions for HF patients. The study by Ong et al. (2016) has the most relevant data, and likely the most worth to practice since it takes place in California, which is where future practice change is to be implemented. The article by Long (2017) was a systematic review of studies that took place in the US, but many of the articles had limited sample sizes so may have led to skewed results. The articles by Blum and Gottlieb (2014), Garcia et al. (2019), Durante et al. (2019) and Bernocchi et al. (2017) took place in the US and Italy respectively,

making them less relevant than a study that took place in California, but still relevant to this population and setting.

A variety of articles have shown that telehealth can work in many different situations. Woodside et al. (2011) looked at the rural community only and found that their readmission rates significantly decreased. This is in part due to the fact that people in rural communities did not have as much access to healthcare before telehealth, but with the implementation of telehealth they can attend appointments without having to travel long distances. The article by Bernocchi et al. (2017) took place in an urban area in Italy and found significant results. The article by Garcia et al. (2019) gave direction as to how to implement the telehealth, saying that privately funded studies with more structured telehealth yielded better results. Touching on a wide range of studies is very helpful when getting to the implementation phase of a study, as people can see what worked, what did not work, and how to go about future research. Based on the research, telehealth is effective in rural communities, works best with a more structured intervention and involvement of caretakers, and works better when implemented for shorter periods of time as opposed to long term telehealth.

Cost Effectiveness

Additional considerations related to HF and telehealth interventions include cost effectiveness. If telehealth is too expensive of an intervention and is not effective at reducing hospital readmission rates then there is little reason to do it. A study by Grustam et al. (2018) chose patients from a larger European study and researched the cost between usual care, home telemonitoring (HTM), and nurse telephone support (NTS). A similar study by Pandor et al. (2013) performed a systematic review of RCTs to determine the cost and clinical effectiveness of structured telephone support (STS) by a nurse and HTM in HF patients that were discharged

from the hospital within the previous 28 days. They found that HTM and NTS saved an average of $12,479 and $8,207 respectively against usual care (no telemonitoring or televisits) (Grustam et al., 2018). While this study scores a Level III, Quality B on the Johns Hopkins Evidence-Based Research Appraisal Tool (2018) because it is not a RCT, does not clearly display methods and would be difficult to recreate, it does have many benefits and a large sample size of 1,000 people. They found that people are willing to pay more for HTM and NTS, and they decreased overall medical costs. (Grustam et al., 2018). Pandor et al. (2013) found similar results, showing that on average STS saved $11,873 per QALY and HTM saved $28,035 per QALY. Pandor et al. (2013) scored a Level I, Quality A because it is a RCT and provides detailed content, methods, analysis, conclusion, limitation, and recommendation sections. Kasper et al. (2002) found that the cost of the telehealth intervention, while still expensive at a mean of $2,257 per person, was much less expensive than the cost of hospital readmission, which was a mean of $10,085.

These articles concluded that implementing telehealth can save money for the patient and hospital, as it decreases hospital readmissions, and the implementation is not overly expensive since it is not done in person. They also found that people are willing to spend more money on home interventions. Telehealth is worth the additional cost of the intervention because if effective, it will significantly decrease the cost of having hospital readmissions. The decreased hospital readmissions and increased home interventions increased quality of life for patients, as they are overall healthier and feel that they are better cared for with individualized, frequent check-ins.

Rationale

Many research articles did not use a theoretical framework to guide their studies. The study by Grustam et al. (2018) used the Markov Cohort Model, which has shown to be relevant to my PICOT question and the literature reviewed. The Markov Cohort Model is a decision-making model that is laid out like a decision tree and applies when there is a risk that is continuous over time (Sonnenberg & Beck, 1993). It shows that people are always in one of a few different health states, and as events happen, they jump to different states (Sonnenberg & Beck, 1993). As the decision tree gets further out, the decisions become simpler and end up being living or dying (Sonnenberg & Beck, 1993). When people with HF are diagnosed, they jump to a different health state. As people are diagnosed with HF, they must make decisions about their health; one of them being to engage in telehealth education, and ultimately as their disease worsens that could mean living or dying. This can help understand a person's reasoning for engaging in telehealth or for simply adhering to the lifestyle changes that HF brings. If telehealth can convince people that it will ultimately lead to not only decreased readmissions, but decreased mortality, they would be more likely to participate in it and stick with it.

Synthesis

Most studies favor telehealth as an important intervention in the outpatient management of HF. Most of the articles reviewed had a strong study design, such as a RCT or systematic review. Multiple studies demonstrated the benefit of educating not only the patient, but also the caregiver. Multiple studies also found significant results, showing that there were fewer 30-day hospital readmissions when patients received a telehealth intervention. Only one study did not find significant results for 30 and 180-day readmission rates between interventions and usual care despite having a large sample size and being a RCT. With or without changing 30-day readmission rates, the quality of life and QALYs increased for the group receiving the

education. One study demonstrated each individual area in which telehealth helped, such as medication management, diet, readmissions, and mortality. Multiple studies also showed that telehealth can work in rural areas, since the patients do not need to commute to the hospital for their appointments.

Many of these interventions were very costly and used slightly different methods of implementing telehealth. Some implemented video visits with a nurse or nurse practitioner only, while one by Blum & Gottlieb (2014) utilized video visits along with home BP, HR, and weight measurements into their intervention. Also, a few studies had limited sample sizes, which may have skewed results. Future research should focus on implementing telehealth from one individual, such as a nurse, so it is more practical to do in actual implementation and should focus on having a large sample size. Another gap in research is that these studies do not consider patients' comorbidities, as they can greatly affect the frequency of hospital readmission. Many HF patients have comorbidities such as diabetes, hypertension, and hyperlipidemia. Patients with comorbidities are more likely to be readmitted to the hospital and have a lower quality of life.

Overall, most of the research supports the intervention of telehealth to educate HF patients in order to decrease hospital readmissions. In nearly every study, not only did they show a decrease in hospital readmissions, but also a significant decrease in mortality, an increase in quality of life and cost savings. These findings are promising for future practice as they show the short and long-term benefits that telehealth brings. Many studies excluded patients that had unique HF cases, such as people with ventricular assist devices, as they would be outliers.

Implications for Practice

Based on these studies, implementing a telehealth education program can improve quality of life for patients, decrease mortality, and decrease cost for hospitals. With this information, an outpatient telehealth education program would be beneficial for hospitals that see a large number of HF patients. The education should focus on the 30-day post-discharge period and should involve the patient and their caregiver. Future research should be performed to focus on the exact best method of implementation and consider comorbidities.

Conclusion

HF is a very common disease in the US and requires daily management of medications, weight, diet, fluid intake, and exercise. Many studies examined in this paper show the benefits of telehealth education, as it can decrease readmissions, decrease cost, and increase quality of life. Based on this research, the next best step is to take into account comorbidities and determine the most cost-effective method of implementation while still yielding positive results. The future of telehealth is promising as it is growing in popularity, and hopefully it will be able to help many HF patients live better lives.

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Appendix

Purpose of Article or Review	Conceptual Framework/Design/Method	Major Variables Studied (and their definitions)	Measurement of Major Variables	Data Analysis	Study Findings	Level of Evidence (Critical Appraisal Score)/Worth to Practice/ Strengths/Weaknesses/Feasibility /Conclusion(s)/Recommendation
Grustam, A. S., Severens, J. L., De Massari, D., Buyukkaramikli, N., Koymans, R., & Vrijhoef, H. J. M. (2018). Cost-effectiveness analysis in telehealth: A comparison between home telemonitoring, nurse telephone support, and usual care in chronic heart failure management. Value in Health, 21(7), 772–782. https://doi.org/10.1016/j.jval.2017.11.011						
-Determine the cost and clinical effectiveness of STS and HTM in heart failure patients that were discharged from the hospital within the previous 28 days for a heart failure issue.	-None -Systematic review -14 research databases searched -meta-analysis to determine cost -Only cohort studies and RCTs used.	-Variables include mortality, cause of admission, the cost effectiveness of RM versus usual care, and QALYs (burden of disease)	-Mortality measured based on the number of people that passed away in the 28 days -Cost effectiveness measured using the Markov model -QALY's measured based on probability of death and number of hospitalizations	-Mortality: combined number of people that passed away per study -Cost analyzed: cost of RM, hospitalization, and medical staff costs -QALY's assessed using the net-benefit approach and probabilistic sensitivity analysis	-All-cause mortality decreased using HTM (HR=0.77, 95% CrI=0.55-1.08) -No significant results found for STS versus usual care due to poor reporting -QALY's and cost-effectiveness highest with STS saving $11,873 and HTM, saving $28,035	-Level 1, Quality A -Strong study giving a broad overview of the benefits of HTM -Only looked at recent research, making it the most relevant -Limitations: poor reporting on results from studies, not taking into account the ways that each study performed STS and TM, different countries had different usual care methods -Some relevant studies may have been missed –Recommendations: researching what subgroups benefit most from RM and STS, specific descriptions of the interventions should be used to get the most accurate cost analysis

Blum, K., & Gottlieb, S. S. (2014). The effect of a randomized trial of home telemonitoring on medical costs, 30-day readmissions, mortality, and health-related quality of life in a cohort of community-dwelling heart failure patients. Journal of Cardiac Failure, 20(7), 513–521. doi: http://10.1016/j.cardfail.2014.04.016						
- To analyze Medicare claims data and evaluate costs, 30-day readmission rates, mortality and health-related quality of life between people using telemonitoring versus usual care	-None -RCT -The intervention group performed daily monitoring of weight, BP, HR, and heart rhythm. –Patients educated by heart failure nurse practitioner	-Took place in Maryland -206 participants -Diagnosis of heart failure -Were using Medicare insurance -2001-2005	-Reviewed Medicare claims and costs -Objective numbers for hospitalization, length of stay, mortality -Averaged scores for SF-36 and MLHF questionnaires	-SPSS used for all statistical analysis -Performed power analysis for cost -Used an alpha of .05 -Averages taken for the rest of the variables	-75 patients in usual care and 81 in monitored group hospitalized (p=.51) -No difference in Medicare payments -Significant difference in 30-day readmission rates for one year (p<.05) -No difference in mortality (p=.575) -Significant difference in SF-36 and MLHF (p<0.001)	-Level 1 quality B -Strengths: done in the US so it is more generalizable to this population, RCT -Limitations: only done on Medicare participants, which eliminates part of the HF population, outliers were not excluded, as 2 patients received LVAD's, which significantly increased their cost, cause of admission was not monitored. -Feasible study to recreate, as it was simply laid out and described in detail -Quality of life was better for the intervention group, as well as 30-day readmission rates.
Garcia, M. G., Fatehi, F., Bashi, N., Varnfield, M., Iyngkaran, P., Driscoll, A., … Oldenburg, B. (2019). A review of randomized controlled trials utilizing telemedicine for improving heart failure readmission: Can a realist approach bridge the translational divide? Clinical Medicine Insights: Cardiology, 13, 117954681986139. doi: https://10.1177/1179546819861396						

-To review previous studies on telemedicine and HF -Explore evidence to support or discourage Telemedicine for HF	-None -Used articles from previous 10 years -Must be using a form of telehealth -All studies were RCT's -Identified and understood mechanisms, conditions, and outcome of each intervention	-12 papers, 6 supporting, 6 contradicting telemedicine	-Measured using Disease Management Taxonomy Writing Group -Similarities and differences between studies with varying support of telemedicine	-Performed cross-case comparison between supporting and undermining studies	In studies supporting telemedicine: -2321 participants -Mostly funded by private vendors -Average length of study: 8.5 months -Structured phone calls -Structured home telemonitoring In studies discouraging telemedicine: -5241 participants -Mostly funded by government -Average length of study: 12 months -Less structured telephone/monitoring interventions	-Level 1, quality A -Very beneficial for practice and future research as you can clearly see differences in studies and outcomes and what worked or did not -Strengths: using all RCT's, looking at many various reasons for differences. -Weaknesses: difficulty to recreate this study and they did not give a clear definition of their telehealth intervention -Beneficial for future research and practice as you can see what worked for patients and what did not -Future research: discuss literacy level and comorbidities of participants as a variable, and factor in quality of life.
Bernocchi, P., Vitacca, M., La Rovere, M. T., Volterrani, M., Galli, T., Baratti, D., Paneroni, M., Campolongo, G., Sposato, B., & Scalvini, S. (2017). Home-based telerehabilitation in older patients with chronic obstructive pulmonary disease and heart failure: randomized controlled trial. Age and Ageing, 47(1), 82–88. https://doi.org/10.1093/ageing/afx146						

To see how telerehabilitation and telehealth affects quality of life and overall health in COPD and CHF patients	-None -Randomized control trial -Control group received usual care -Intervention group given telehealth and rehab from nurse and physical therapist	-112 patients -Must have diagnoses of HF -Italy	-Variables measured after 2 months of intervention -Compare usual care with intervention group	-Used STATA -All measurement based on 95% confidence interval	-Significant results for: 6 minute walk test (p=0.004), time to hospitalization (p=0.0484), dyspnea improving (p=0.05), PASE (p=0.0015), and MLHFQ (p=0.007)	-Level 1 Quality A -Beneficial to future practice as it finds beneficial results when using telehealth via nurse and physical therapist, a feasible study -Limitations: did not discuss the details of the method of intervention performed by RN and PT, this intervention is suited to people who can do more physical activity. Strengths: RCT, quality of life was assessed, and people of all ages participated -Future recommendations: trialing in multiple geographic locations and utilizing only one practitioner to decrease cost
Pandor, A., Thokala, P., Gomersall, T., Baalbaki, H., Stevens, J., Wang, J., … Fitzgerald, P. (2013). Home telemonitoring or structured telephone support programmes after recent discharge in patients with heart failure: systematic review and economic evaluation. Health Technology Assessment, 17(32). doi: 10.3310/hta17320						

-To determine how cost effective HTM and NTS is against usual care as well as the change in QALY's	Markov cohort model - Used data from previous, larger study (TEN-HMS)	-1000 people in Europe -70 years or older -CHF diagnosis	-Used Markov model to determine monetary differences, average costs of each group measured -QALY measured based on cost of intervention, hospitalizations, and number of patient hospitalizations	-Institute for Medical Informatics and Biostatistics used -Used averages of each group	-HTM gained 2.93 QALY's -NTS gained 3.07 QALY's -People willing to pay more for HTM and NTS -HTM saved $12,479 -NTS saved $8207	-Level II, Quality B -Benefits: you can see that while these interventions are expensive, they save money in the long run and people are willing to spend more for the intervention, seeing how QALY is increased along with cost and you can compare telemonitoring versus nurse telehealth -Weaknesses: difficulty duplicating, the TEN-HMS study was 15 year old data so new technology is available now. -Recommend using HTM or NTS depending on availability of staff and trying new technology, which could be beneficial
Ong, M. K., Romano, P. S., Edgington, S., Aronow, H. U., Auerbach, A. D., Black, J. T., Marco, T. D., Escarce, J. J., Evangelista, L. S., Hanna, B., Ganiats, T. G., Greenberg, B. H., Greenfield, S., Kaplan, S. H., Kimchi, A., Liu, H., Lombardo, D., Mangione, C. M., Sadeghi, B., … Fonarow, G. C. (2016). Effectiveness of remote patient monitoring after discharge of hospitalized patients with heart failure: The better effectiveness after transition–Heart failure (BEAT-HF) randomized clinical trial. JAMA Internal Medicine, 176(3), 310–318. https://doi.org/10.1001/jamainternmed.2015.7712						

-To determine the value of 180-days of remote patient monitoring after discharge for heart failure patients to see if they have an increased quality of life and decreased hospital readmissions	-None -RCT -Usual care versus BEAT-HF for 180 days	-1437 participants -6 hospitals in California	-Quality of life used MLHF -Cause of admission measured through hospital charts	-Used 95% CI -Took averages of each group -Did not mention software used	-No significant results for: 180-day readmission (p=0.74), 30-day readmission (p=0.56), 180-day mortality (p=0.3), 30-day quality of life (no statistic given) -Significant results: 30-day mortality (p=0.04), 180-day quality of life (p=0.02)	-Level I, Quality A -Strengths: RCT, is repeatable, took place in California -Limitations: not enough funding to obtain enough power for the study, possibly altering results as well as not having strong control over the nurse doing the intervention -feasible based on the location and details integrated into the review -Recommendations: broadening the population studied and having more time and funding to obtain proper power
Durante, A., Paturzo, M., Mottola, A., Alvaro, R., Vaughan Dickson, V., & Vellone, E. (2019). Caregiver Contribution to Self-care in Patients With Heart Failure. The Journal of Cardiovascular Nursing, 34(2), E28–E35. https://doi.org/10.1097/jcn.0000000000000560						
Caregiver contribution to HF patients	-None -Qualitative -60 min conversation	-Italy -40 people -interview, 1 hr -semi-structured	-Major themes identified	- Qualitative content analysis	-Knowledge from friends, family, neighbors -Did med mgmt., weight, diet, exercise -trouble with symptom mgmt.	-Level III, quality A -Limitations: took place in Italy so results not super generalizable, would be good to see results at beginning of caring, 6 months in, and 1 year in. Overall good to see caregivers perspective to understand what telehealth should focus on
Kasper, E. K., Gerstenblith, G., Hefter, G., Van Anden, E., Brinker, J. A., Thiemann, D. R., Terrin, M., Forman, S., & Gottlieb, S. H. (2002). A randomized trial of the efficacy of multidisciplinary care in heart failure outpatients at high risk of hospital readmission. Journal of the American College of Cardiology, 39(3), 471–480. https://doi.org/10.1016/s0735-1097(01)01761-2						

-Find benefits of telehealth and in-person HF education -readmission, deaths, diet and medication compliance, symptoms, cost	-None -6 month intervention -RCT -increase telehealth and in-person education	-US East Coast -200 patients	-60-day post intervention measurement	-Statistics -P-value for each variable -did not mention software used	-decreased hospitalizations (p=0.09) -decreased deaths (p=0.03) -increased diet compliance (p=0.02) -increased medication compliance (p<0.001)	-Level I quality A -Limitations: not addressing comorbidities, not taking into account caregiver assistance at home -Recommendation: include comorbidities and at-home support
Long, G. (2017). Impact of Home Telemonitoring on 30-Day Hospital Readmission Rates for Patients with Heart Failure: A Systematic Review. MEDSURG Nursing, 26(5), 337–348. http://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=2&sid=ed918601-2fb9-4c88-bdf4-b547037b3195%40sessionmgr103						
Evaluate effect of home telemonitoring on 30-day readmission rates	-None -Systematic review	-6 studies -All in US -2011-2016 -Most Medicare	-Combination of each study -Measured in percentage	-Averages from each study -Measured as percentage	-Readmission rates decreased by 2% -Limited data available -Some studies had small sample sizes -Mortality decreased 50%	-Level 1 Quality A -Strong worth to practice as you can see results from many articles at once and each article from US -Limitation: some studies had small sample sizes and limited data available for 30-day and in US variables -More research should be done and have larger sample sizes.

Woodside, P. A., Schofield, L. C., & Holman, C. (2011). 3. Use of telehealth to reduce heart failure readmissions in a rural community. HEART AND LUNG. http://eds.b.ebscohost.com/eds/detail/detail?vid=0&sid=e06467d2-8c3e-4d04-bcb4-7da2d19c6751%40pdc-v-sessmgr04&bdata=JkF1dGhUeXBlPXNzbyZzaXRlPWVkcy1saXZlJnNjb3BlPXNpdGU%3d#AN=RN293813992&db=edsbl						
See effectiveness of telehealth on rural hospitals on 30-day readmission rates	-None -Quasi-experimental	-Participants from 3 hospitals in northern Michigan -70 people	-Percentage increase or decrease of readmissions	-Statisticspercentage change of admission rates	-Decreased by 2.9% in 2007 -Decreased by 2.5% in 2008 -Decreased by 2.23% in 2009	-Level II Quality B -Limitations: small sample size and quasi-experimental -Strengths: well-laid out implementation, feasible to redo. Recommend: larger sample size and trying multiple regions of US in the future