

A systematic review of the effectiveness of nurse coordinated transitioning of care on readmission rates for patients with heart failure

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Executive summary

Background Readmission rates for patients with heart failure are a major concern for hospitals worldwide. The importance of patient education and a structured care plan to ease the transition from hospital to home has been the focus of many intervention strategies to reduce readmission rates. The use of transitioning of care plans is believed to improve medication reconciliation, communication, patient education, and follow-up. To date, the evidence has not been systematically evaluated to support the effectiveness of a nurse coordinated transitioning of care for patients with heart failure in reducing readmission rates.

Objective The objective of the systematic review was to identify the best available evidence on the effectiveness of nurse coordinated transitioning of care between hospital and home on hospital readmission rates for all causes in adult patients hospitalised with heart failure.

Search strategy The search strategy aimed to find both published and unpublished studies in the English language from January 1975 through July 2010. A search of MEDLINE, CINAHL, PsycINFO, Healthsource Nursing/academic edition, EMBASE, the Cochrane Library, and the Joanna Briggs Institute Library of Systematic Reviews was conducted followed by a reference search of relevant studies. The initial key words searched were: heart failure, readmission, and transitional care.

Inclusion criteria Randomised controlled trials that evaluated the effect of nurse coordinated transitioning of care from hospital to home in adult patients with heart failure on readmission rates were selected. The outcome was defined as hospital readmissions for all causes following an initial admission for heart failure.

Data collection and analysis Studies selected for retrieval were critically evaluated by two independent reviewers for methodological validity using standardised critical appraisal instruments from the Joanna Briggs Institute Meta Analysis of Statistics

Assessment and Review Instrument (JBI-MAStARI). Data were extracted and analysed using the JBI-MAStARI program.

Results A total of 16 randomised controlled studies were included. Ten of the 16 studies included in the review show that a nurse led transitioning of care intervention can reduce the rate of readmission for patients with heart failure. Interventions utilising home visits, or home visits coupled with telephone follow-up, show a more favourable reduction in readmission rates.

Conclusions Reduced readmissions occur when transitioning of care interventions are carried out by a heart failure trained nurse who conducts at least one home visit and follows the patient at least weekly for a minimum of 30 days post discharge with either additional home visits or telephone contact.

Implications for practice This review supports the development of a nurse coordinated transitioning of care plan which will require improvements in communication, in addition to changes in health policy and payment systems that align incentives and performance measures in caring for patients with heart failure.

Implications for research Future research should evaluate the effect of the intensity and duration of the transitioning of care intervention on readmission rates in a large randomised control trial on an adult population with heart failure to determine the ideal frequency and duration of the post discharge interventions.

Keywords Heart failure, readmission, transitional care, transition, disease management, case management, multidisciplinary care, patient discharge, discharge planning, patient care planning, care coordination, after care, guided care, hospital to home.

Background

Heart failure (HF) is a chronic condition, characterised by high mortality, frequent hospitalisations, and decreased quality of life. Some researchers have demonstrated that patients with HF commonly fail to recognise the increasing severity of their symptoms due to the ubiquitous nature of the dyspnoea, cough, oedema and orthopnea associated with HF¹. Early symptoms of decompensation, such as fatigue and dyspnoea, may also be discounted as due to benign causes, such as aging or side effects of pharmacological management^{2,3}, leading to an insidious increase in symptoms and hospital admissions.

HF is a global disease creating a major health burden worldwide. The average incidence of HF is 15 per 1000 persons over age 55 with an increasing incidence in older people⁴. HF impacts the lives of more than 15 million adults in Europe⁵, five million adults in the United States (U.S.)⁶, and 300,000 adults in Australia⁷. Data from many parts of the world, especially Asia and Africa, are sparse, which limits a true global estimate of the burden of HF⁶. Within five years of diagnosis, only one in five patients with HF is still alive⁸. According to Healthy People 2010, a comprehensive set of disease prevention and health promotion objectives for the U.S., hospitalisations for older adults continue to rise and the number of adults with HF is expected to double by the year 2040⁹. Reducing hospitalisations for older adults with HF remains a goal for Healthy People 2020¹⁰.

Readmissions of patients with HF are a major concern as patients may further decondition with each hospitalisation affecting morbidity and mortality, quality of life, and costs of care. Readmission rates are the tracking of data on the number of patients who experience an unplanned admission to the

same hospital, a different hospital, or another acute care facility for HF or for a different diagnosis after a previous admission for HF¹¹. Thirty-day readmission rates are calculated and adjusted for differences in hospital size and patient condition¹². Patient care during the initial hospital stay is perceived to be of higher quality when the readmission rate is low.

Care for chronic conditions is becoming a top priority for hospitals as health reform continues to unfold in the U.S. Contained within the U.S. Patient Protection and Affordable Care Act of 2010 is a measure to reduce reimbursement rates for readmission for many common conditions, including HF. This measure is set to go into effect in October 2012¹³; however, 30-day HF readmission rates are currently being monitored and may have retroactive financial implications once implemented in October 2012.

HF is the principle diagnosis for approximately one million hospital discharges annually in the U.S. alone⁶. More than 26% of these patients are readmitted within 30 days of discharge¹⁴ and 65% of patients over the age of 65 with Medicare, a U.S. government provided health insurance, are readmitted within one year¹⁵. In the U.S., the rate for 30-day readmissions related to HF based on hospitalisation between July 2005 and June 2008 was 24.5%⁵. Out of 4,787 hospitals in the U.S., 180 performed better than the national rate, 3,854 performed no different than the national rate, and 233 performed worse than the national rate (520 had too small a number of cases to estimate performance rates)¹².

The direct and indirect costs of HF are estimated to be \$34.8 billion (U.S.) annually¹⁶. While evidence-based measures for HF care in hospitals have increased from 59.7% in 2002 to 91.6% in 2008¹⁷, the incidence of HF and the costs of care continue to rise⁶. Fifty two percent of the patients with HF readmitted within 30 days did not have a bill for an outpatient visit between discharge and readmission¹⁴. The U.S. Centers for Medicare and Medicaid Services (CMS) and The Joint Commission requirements to report on four core measures for HF have contributed to improved quality of care¹⁸. Continued assessment of processes and outcomes is needed to further reduce the burden of HF on the American health care system.

The four core measures related to HF care are: (a) the percent of patients given discharge instruction, (b) the percent of patients given an evaluation of left ventricular systolic function, (c) the percent of patients given an angiotensin converting enzyme (ACE) inhibitor or an angiotensin receptor blocker (ARB) for left ventricular systolic dysfunction, and (d) the percent of patients given smoking cessation advice or counselling⁵. CMS publishes 30-day mortality and 30-day readmission rates after hospitalisations for HF⁵. These measures are potential indicators for poor quality care or the need to improve care coordination¹⁹.

Hospitals are undertaking initiatives to improve inpatient and post discharge care, discharge planning, and patient education in an effort to meet the core standards. Nonetheless, Ross and colleagues¹⁹ showed that there have been no recent improvements in readmission rates. Significant improvements in HF care are needed either through enhanced inpatient care, coordinated discharge planning, or improved transition from hospital to home.

The impact of patient outcomes during the hospital discharge process is a critical area of study. The U.S. Agency for Healthcare Research and Quality (AHRQ) has found poor discharge planning, medication reconciliation errors, structured communication flaws, and improper patient education are significant causes of adverse patient outcomes upon hospital discharge²⁰. The recognition of this problem has led to researching various methods for improving the transitioning of care between hospital and home. Transitioning is the concept of the patient flow through various health care settings such as the movement from the hospital through the discharge process and into the home.

Transitioning promotes new skills, and develops relationships and coping strategies^{21,22}.

The goal of a transitioning of care plan is to impact the discharge process by improving medication reconciliation, communication, patient education, and follow-up thereby reducing readmission rates. Several transitioning models have been developed such as the Transitional Care Model²³, the Guided Care Model²⁴, and the Care Transitions Model²⁵. Each of these models relies on a nurse or advanced practice nurse (APN) to coordinate care with the collaborative, interdisciplinary team. The nurse's role is focused on individualised patient assessment, enhanced patient-provider communication, improved access to resources, and targeted interventions, such as patient and caregiver education, to improve self-management²⁶. Research evaluating the use of nurse coordinated transitioning of care models on older adults hospitalised with various health conditions has shown reductions in readmission rates^{27,28,29}.

A focus on transitioning of care between the inpatient and outpatient settings for adult patients hospitalised with HF will likely have a greater impact on patient outcomes than focusing on each element in the discharge process independently. HF is a chronic condition and patients require frequent monitoring along with reinforcement of self-care behaviours and medication reconciliation in order to prevent exacerbation of symptoms and readmissions. The focus on readmission rates for patients with HF presents a critical need at this juncture to identify effective interventions for transitioning of care for patients with HF.

Review question/objective

The objective of this review was to identify the best available evidence on the effectiveness of nurse coordinated transitioning of care between hospital and home on hospital readmission rates for all causes in adult patients after a hospitalisation for HF.

Criteria for considering studies for this review

Types of participants

This review included studies with adult patients, 18 years of age or older, hospitalised with HF being discharged to home.

Types of intervention(s)/phenomena of interest

Models of nurse coordinated transitioning of care from hospital to home, defined as inpatient evaluation and education coupled with post discharge home-based and/or telephone education and support by a nurse, and compared to usual care were evaluated in this review.

Types of outcomes measures

The outcome measure studied in this review was hospital readmissions for all causes.

Types of studies

In this review, any randomised controlled trial (RCT) that studied the effect of transitioning of care from hospital to home in adult patients with HF on readmission rates was considered for inclusion. RCTs are considered the highest level of evidence for a systematic review and for meta-analysis of effectiveness evidence³⁰. In the absence of RCTs, non-randomised controlled trials and before and after studies were also considered.

Search strategy

The authors of this systematic review searched the databases of MEDLINE, CINAHL, PsycINFO, Health Source: Nursing/Academic Edition, EMBASE, the Cochrane Library, and the Joanna Briggs Institute Library of Systematic Reviews to gather evidence on HF transitioning of care interventions and their effect on hospital readmission rates. The search strategy aimed to find both published and unpublished studies available in or translated into the English language from January 1975 through July 2010. A three-step search strategy was utilised in each component of this review. An initial limited search of MEDLINE and CINAHL was undertaken followed by an analysis of the text words contained in the title and abstract, and of the index terms used to describe the study. A second search using all identified keywords and index terms was then undertaken across all included databases. A full report was retrieved for all studies that met the inclusion criteria. Thirdly, the reference list of all studies that meet the inclusion criteria was searched for additional relevant studies. Studies identified from reference list searches were assessed for relevance based on the study title.

The search for unpublished studies included: Scirus, New York Academy of Medicine, The Virginia Henderson International Nursing Library, Google Scholar, reference list from selected articles, and communication with leading authors in the field.

Relevant journals from the prior year were hand searched to assure inclusion of the most recent studies: *American Heart Journal*, *American Journal of Cardiology*, *Circulation*, *Heart and Lung: The Journal of Acute and Critical Care*, *Journal of the American College of Cardiology*, *Journal of Cardiovascular Nursing*.

Initial keywords were: heart failure, readmission, transitioning care. The full list of keywords used was: heart failure, readmission, transitional care, transition, disease management, case management, multidisciplinary care, patient discharge, discharge planning, patient care planning, care coordination, after care, guided care, hospital to home. The time frame for the database search strategy was from January 1975 through July 2010.

Steps 1-15 indicate the MEDLINE only search for major subject headings. Steps 16-23 indicate the CINAHL only search for major subject headings. Steps 24-32 are a combined search of MEDLINE, CINAHL, Health Source: Nursing/Academic Edition, and PsycINFO using all identified search terms.

1. ("Heart failure") or (MM "Heart Failure") or (MM "Heart failure, Diastolic") or (MM "Heart failure, Systolic")
2. ("Readmission") or (MM "Patient Readmission")
3. readmit*
4. readmission*
5. ("disease management") or (MM "Disease Management")
6. transition*
7. (patient care planning) or (MM "Patient Care Planning") or (MM "Continuity of Patient Care")
8. ("aftercare") or (MM "Aftercare")
9. "hospital to home"
10. "guided care"
11. "multidisciplinary care"
12. ("patient discharge") or (MM "Patient Discharge")
13. "discharge planning"
14. ("case management") or (MM "Case Management")
15. "care coordination"
16. ("heart failure") or (MM "Heart Failure, Congestive")

17. (“readmission”) or (MM “Readmission”)
18. (“aftercare”) or (MM “After Care”)
19. (“transitional care”) or (MM Health Transition”) or (MM “Transitional Programs”)
20. (“patient care planning” or (MM “Patient Care Plans”) or (MM “Continuity of Patient Care”)
21. (“patient discharge”) or (MM “Patient Discharge”) or (MM “Patient Discharge Education”) or (MM “Discharge Planning”)
22. (“care coordination”) or (MM “Nursing Care Coordination (Saba CCC)”)
23. “transitional care”
24. (#1) or (#16)= 129756
25. (#5) or (#6) or (#7) or (#8) or (#9) or (#10) or (#11) or (#12) or (#13) or (#14) or (#15) or (#18) or (#19) or (#20) or (#21) or (#22) or (#23)=549321
26. (#2) or (#3) or (#4) or (#17)=17144
27. (#24) and (#25) and (#26)=351
28. (#24) and (#25) and (#26) with Limiters: Peer reviewed, English Language, Human, All Adult: 19+ years (MEDLINE)
29. (#24) and (#25) and (#26) with Limiters: Exclude Medline Records; Peer reviewed, English Language, Human, All Adult: Adulthood,18+ years (CINAHL)
30. (#24) and (#25) and (#26) with Limiters: Peer reviewed, Human; Adulthood, All Adults (PsycINFO)
31. (#24) and (#25) and (#26) with Limiters: Peer reviewed, Human; Adulthood, All Adults (Health Source: Nursing/Academic Edition)
32. (#28) and (#29) and (#30) and (#31)=250

EMBASE, the Cochrane Library, and the Joanna Briggs Institute Library of Systematic Reviews were searched independently using the identified key words. No additional studies were identified from these databases.

Methods of the review

Assessment of methodological quality

Quantitative papers selected for retrieval were assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardised critical appraisal instruments from the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix I). Any disagreements that arose between the reviewers were resolved through discussion, or with a third reviewer.

Data collection/extraction

Quantitative data were extracted from papers included in the review using the standardised data extraction tool from JBI-MAStARI (Appendix II). All results were subject to double data entry. The data extracted included specific details about the interventions, populations, study methods and outcomes of significance to the review question and objective.

Data synthesis

Quantitative papers were pooled in statistical meta-analysis using JBI-MAStARI. Absolute risk and relative risk with 95% confidence intervals were calculated for analysis using JBI-MAStARI. Heterogeneity was assessed using the standard Chi^2 . I^2 was also calculated to evaluate the impact of heterogeneity on the meta-analysis as the power of Chi^2 in meta-analyses conducted on small numbers of studies is low³¹.

Review results

Description of studies

The advance search strategy led to a total of 250 relevant papers, 20 of which were duplicates. After the authors reviewed these papers by title and keywords, 97 papers were excluded. Abstracts were reviewed by the authors on 133 papers and 98 papers were excluded leaving 35 papers for complete review. Ten additional papers were identified through a review of the reference lists, of which 2 were relevant. The remaining 37 papers were critically appraised for methodological quality by two independent reviewers. Twenty-one studies did not meet the inclusion criteria for the systematic review. A total of 16 studies were identified as relevant for inclusion. Figure 1 outlines the process used to identify the relevant studies included in this review.

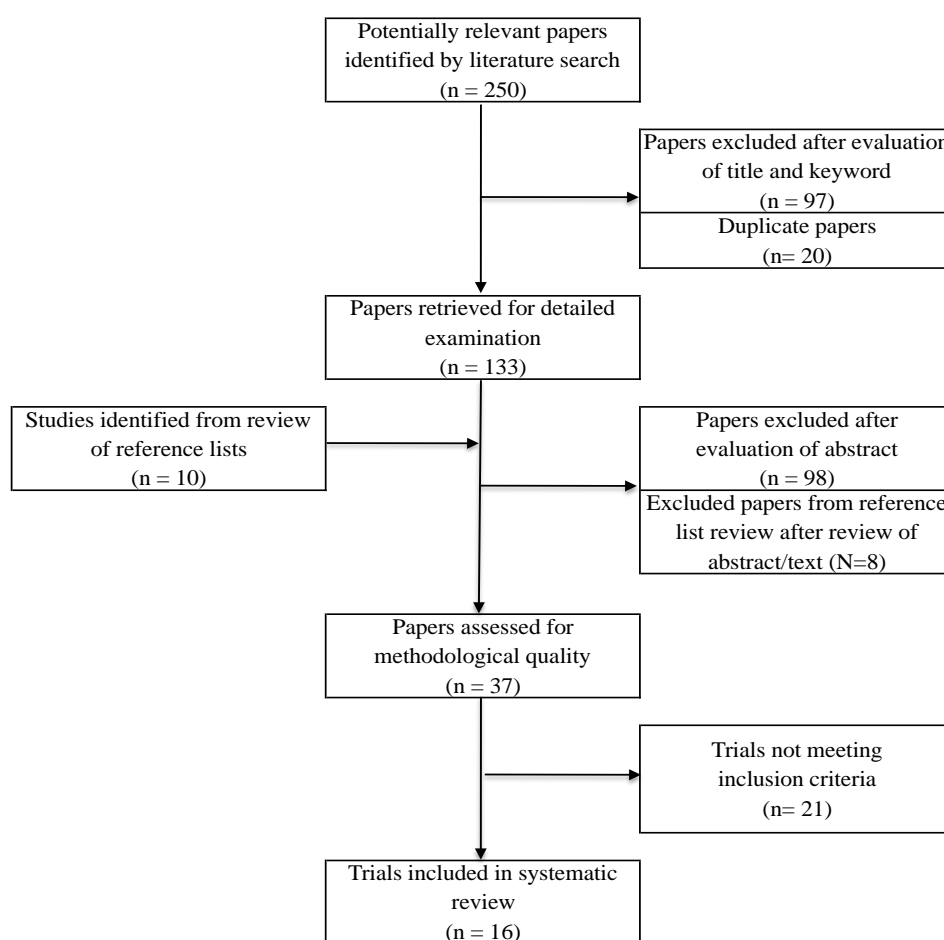


Figure 1. Stages of literature search.

Methodological quality

The 16 studies included are all RCTs³²⁻⁴⁷. They were all graded as moderate to high level of evidence using the JBI-MAStARI appraisal criteria by two independent reviewers. The methods of randomisation included using a computer generated schedule^{34,36,41,44-46}, the Efron procedure³³, random number tables³⁷, a randomisation list³², simple randomisation in blocks of eight³⁸, drawing from an envelope³⁴ and a 2:1 basis stratified by risk⁴³. Four of the studies did not state the method of participant randomisation^{39,40,42,46}. There was full agreement among the reviewers to include these studies as the other aspects of quality of the papers were satisfied.

Baseline similarity between intervention and control groups was clearly documented in all 16 studies. Due to the nature of transitioning of care as an intervention, it was impossible to include blinding for the participants to the treatment. The sample sizes of the included studies ranged from 70 to 683, with a median of 189.5. The interventions used in the studies varied in terms of the type, intensity and duration of the transitioning of care programs. Intensity, for the purposes of this review, is defined as the intervention frequency, content, quality, and continuity of the health care provider. The interventions included in this review utilised home visits, telephone follow-up, or a combination of both over a range of one week to one year post discharge.

Characteristics of included studies

A total of 16 RCTs describing 15 studies were included in this review. A summary of the included studies, the transitioning of care intervention used in each study, the duration of the intervention, and the time point through which readmissions were measured is shown in Appendix III. The included studies were all published between 1993 and 2008.

The population of all studies was derived from patients admitted to acute care hospitals with a diagnosis of HF. Six studies were conducted in the U.S.^{33,38,41,43,44,47}, one study was conducted in Canada³⁴, six studies were conducted in Europe^{32,35,36,40-42}, two studies were conducted in Australia^{45,46}, and one study was conducted in Asia³⁷.

The participants of the studies were adult patients with HF. The mean age of all but one study⁴⁷ was over 65 years. There was no distinction between systolic and diastolic HF in most of the studies. Inclusion criteria included symptoms consistent with HF and radiologic evidence of HF (either evidence of decreased left ventricular systolic function or pulmonary congestion). There was some variation in the severity of symptoms as defined by the New York Heart Association (NYHA) classification across the studies.

The transitioning of care interventions used in all the included studies incorporated both inpatient HF education coupled with ongoing education and support for the patient after being discharged home. The post discharge interventions were carried out through either telephone contact with the patient at home^{33,38-40,42,47}, home visits to the patient^{37,41,45}, or a combination of both telephone calls and home visits^{32,34-36,44-46}. The post discharge interventions were coordinated and or carried out by a nurse or APN in all of the studies. The number of nurse/patient contacts that occurred post discharge varied amongst the studies from a single telephone call or home visit to 16 or more encounters. Overall, the study authors did not elaborate on the nature of usual care carried out in the control groups.

Six studies utilised the telephone contact only intervention^{33,38-42,47}. Post discharge interventions in the telephone only group utilised telephone calls by the nurse to the patient at home to assess status and provide additional education as needed.

Debusk³³ utilised a best practice program developed by Rich⁴³. A nurse provided a one hour education session prior to discharge. The patients received printed educational materials, information on self-monitoring of symptoms, daily weight, medications, and dietary management. Patients were also given instructions on how to access emergency care if symptoms worsened. Telephone contact by a nurse care manager, under physician direction, occurred weekly for six weeks, every other week for eight weeks, monthly for three months, and every other month for six months. The nurse care managers spent nine hours per patient coordinating the treatment plan with the patient and physician. Details of the dietary and physical therapy consultations and the telephone contact by the nurse case manager were not discussed. At one year, 51% of the intervention group and 50% of the usual care group were readmitted. The researchers believed the lack of a statistically significant difference in

treatment effect was due to the low risk sociodemographic and medical attributes of the participants and the quality of usual care services.

Laramee³⁸ utilised a HF trained nurse case manager to assess and elicit early discharge planning, facilitate consults with a dietician and social services, and coordinate daily education for patient and family needs. The case manager notified the patient's cardiologist when the patient was discharged. The case manager utilised evidence-based guidelines to assess and reinforce the educational plan through telephone contact with the patient. Telephone contact occurred one to three days post discharge, weekly for four weeks, and then every other week for eight weeks. Both the intervention and usual care group had a 37% all-cause readmission rate at 12 weeks post discharge. Readmissions for HF were lower in the intervention group compared to usual care (14% vs. 17%). The intervention group also required fewer days of hospitalisation. The researchers believed the heterogeneity in functional class of their sample possibly resulted in the lack of favourable outcomes with this intervention.

A HF nurse specialist provided education to inpatients in the McDonald^{39,40} studies. The education incorporated medication teaching, recognition of worsening symptoms, reinforcement of dietary teaching, and monitoring weights. The patient was also visited by a dietician three or more times to review sodium restriction, daily weight monitoring, and understanding of their disease process. All patients in both in the intervention and control groups in the McDonald studies^{39,40} met established prerequisites for stability at discharge and were sent home on optimum doses of HF medications. The patient received a telephone call from the same HF nurse from the inpatient setting at three days post discharge to assess the clinical status and stability of the patient. The patient had a follow up appointment two and six weeks post discharge in the HF clinic. Discussion of key educational issues facilitated revision of the patient's care plan. At one month³⁹, there were no readmissions in either the intervention or control group. At three months⁴⁰, 2% of the intervention group compared with 23% of the usual care group were readmitted due to HF. These favourable results are likely attributed to the impact of multidisciplinary care combined with optimal medical therapy and further enhanced by a transitioning of care plan and post discharge follow-up.

Nucifora⁴² utilised a HF research nurse who provided a face-to-face half hour inpatient educational session for treatment management using a HF guideline booklet developed by study investigators. This booklet contained similar education as provided in the other studies inclusive of smoking and alcohol abstinence. Patients in the intervention group had telephone contact with the HF research nurse three to five days post discharge to reinforce education and assess compliance with the treatment plan. Patients received an appointment in the HF outpatient clinic 15 days, one month, and six months post discharge to assess clinical progress and adherence with the research nurse reinforcing necessary education. There were more readmissions after six months in the group that received the transitional intervention than in the usual care group (48% vs. 43%). Both the usual care and intervention groups received optimal medical care, which may have obscured any benefit from the intervention. Moreover, the brief, single event, post-discharge intervention was likely not sufficient to show a reduction in readmission over the six month follow-up period.

Weinberger⁴⁷ utilised a primary care nurse to assess the patient's educational needs and develop a problem list. The nurse provided written educational material and telephone contact numbers for the physician and nurse. The physician reviewed the problem list and medication regimen. Prior to discharge the patient was given an appointment to see the primary care physician in one week. The primary care nurse telephoned the patient two days post discharge to address difficulties and problems. The primary care physician and nurse updated the plan of care after the patient appointment. The nurse communicated with the patient to remind them of missed and future

appointments. The rate of readmission after six months in the intervention group was 49%, compared to 44% in the usual care group. The significantly higher readmission rate in the intervention group may have reflected an increase in the diagnosis of co-morbidities and a resulting increase in care caused by the improved communication afforded by the intervention with this high risk population.

Three studies^{37,41,45} used home visits alone to facilitate the transitioning of patient care. The nurse visited the patients in their home to assess the patient for worsening signs and symptoms and additionally provide education and support. Dietary and physical therapy interventions were not discussed in detail in these studies^{37,41,45}.

In Kwok³⁷, patients with HF were counselled by a community nurse about dietary and medication compliance prior to discharge. The nurse visited the patients within one week of discharge, then weekly for four weeks, and monthly for five months. These visits were to review symptom management and to reinforce dietary and medication issues. There was a 43% readmission rate in the patients who received transitioning of care after six months compared to 52% in those who received usual care.

In Naylor⁴¹, APNs were trained by a multidisciplinary team of HF experts composed of a geropsychiatric clinical nurse specialist, pharmacist, nutritionist, social worker, physical therapist, and board-certified cardiologist specialising in the treatment of HF. The APNs visited the hospitalised patients daily to address their unique educational needs. Care management strategies from the Quality-Cost Model of APN Transitional Care were utilised to develop individualised care plans for patients and caregivers educational needs. The APNs used an evidence-based protocol formulated by HF guidelines to focus on comprehensive management. The APN visited the patient at home within 24 hours post discharge and for at least eight additional visits. Home visits to assess medications, symptoms, dietary, and other patient needs occurred weekly for the first month and bimonthly for the second and third month. There was a 45% readmission rate in the intervention group after 12 months compared to 55% in the usual care group.

In Stewart⁴⁵, a nurse provided inpatient education and counselling on treatment compliance and signs of clinical deterioration. The study nurse visited the patient one week post discharge to assess patient's needs. A pharmacist also visited the patient one week post discharge to reinforce medication compliance. At six months post discharge 49% of patients in the intervention group were readmitted compared with 65% of patients in the usual care group.

Seven studies^{32,34-36,43,44,46} utilised a combination of home visits and telephone contact for their transitioning of care intervention. Each studied included a minimum of one home visit in addition to telephone follow up to assess patient needs and provide ongoing education and support.

In Blue³², the cardiac trained nurse used a written protocol and patients were given a booklet that included a definition of HF, symptoms, treatments, dietary restrictions, daily weights, necessary blood tests, contacts for the HF nurses, in addition to dates and times of follow up appointment and visits. The inpatient nurse education was supplemented with home visits and telephone contact but details of the number of actual encounters were not provided. The readmission rate was 56% for the intervention group and 60% in the usual care group at one year post discharge.

Harrison³⁴ utilised written protocols for HF management, community resources, and support services. Patients received a telephone call from the hospital nurse within 24 hours post discharge. There was also a minimum of two home visits within two weeks of discharge to assess the patient's needs. At 12 weeks, there was a 23% readmission rate in the intervention group compared to 31% in the usual care group.

In Jaarsma³⁵, a cardiac trained study nurse educated HF patients through a standard nursing care plan developed by the researchers. The study nurse telephoned the patient within one week and visited the patient at home within 10 days post discharge. The authors reported a 37% readmission rate in the intervention group at nine months compared to 49% readmission rate in the usual care group.

Jaarsma³⁶ utilized a similar written protocol to Harrison³⁴, in addition to advice provided by a physical therapist, dietician, and social worker. The nurse provided weekly telephone contact and two home visits over one month in addition to cardiac nurse visits in an outpatient clinic. The intervention group had a 53% readmission rate compared to 56% in the usual care group at 18 months. This 30-day intervention was unable to improve readmission rates out to 18 months over usual care. Both the intervention and usual care groups had more frequent contact with the cardiologist and heart failure nurse than in the planned protocol. This may have contributed to improved outcomes in the usual care group.

Cardiac nurses provided daily inpatient education in the Rich^{43,44} studies utilising a HF teaching booklet developed by the study investigators. A dietician assessed and developed an individualised dietary plan. The cardiac nurse would reinforce the dietary plan in addition to other educational needs. Home visits occurred within 48 hours of patient discharge by home care nurses who repeated the visits two additional times within one week post discharge. The home care nurses continued to visit the patient at regular intervals per homecare guidelines. A cardiac nurse also telephoned the patient at regular intervals. In Rich⁴³, the readmission rate at three months was 33% for the intervention group compared to 46% in the usual care group. The Rich⁴⁴ study demonstrated a readmission rate of 29% for the intervention group and 42% for the usual care group at three months.

In Stewart⁴⁶, a cardiac nurse, dietician, social worker, pharmacist, and community nurse consulted with the patient to assess the patient's needs and plan for the transition home. Telephone contact was made by a cardiac nurse at three and six months in addition to one home visit seven to fourteen days post discharge to assess the patient's needs. Readmission rates for this study demonstrated 31% for the intervention group and 34% for the usual care group at six months.

Results

All studies included a control group receiving usual care and a transitioning of care intervention group with sample sizes that ranged from 70 to 683 (median 189.5). The duration of the transitioning of care intervention varied from less than a week to 12 months in time (see Appendix III). The nurse coordinated transitioning of care interventions all included inpatient education and comprehensive discharge planning coupled with telephone contact^{33,38-40,42,47}, home visits^{37,41,45}, or a combination of both post discharge interventions^{32,34-36,43,44,46}. The measured outcome was hospital readmission rates for patients with HF. Timing of readmission measurement varied from 30 days³⁹ to three months^{34,38,40,43,44}, six months^{37,42,45,46,47}, nine months³⁵, 12 months^{32,33,41} and 18 months³⁶. Ten of the 16 studies^{32,34,35,37,40,41,43-46} demonstrated nurse coordinated transitioning of care interventions that reduced readmission rates for patients with HF; two^{40,44} were statistically significant.

Meta-analysis was performed using the JBI-MAStARI software to calculate the DerSimonian & Laird relative risk for three types of post discharge interventions: telephone follow-up alone, home visit alone, or home visit with telephone follow-up. A random effect model was chosen given the variability in the intensity of interventions between studies. Heterogeneity was calculated by the JBI-MAStARI software using the Chi² statistic, with $p < 0.1$ showing statistically significant heterogeneity. I^2 was also calculated for each group. Negative values of I^2 were made to equal zero so that I^2 ranges from

0% to 100% with values of 25%, 50% and 75% correlating with low, moderate, and high levels of heterogeneity respectively³¹.

In JBI systematic reviews, clinical differences between studies (types of participants, types of interventions, types of outcomes) are examined. There are seven basic categories of differences among included studies in a systematic review that may have impact on interpretability of the results of meta-analysis: differences in inclusion and exclusion criteria; differences in baseline states of patients despite identical selection criteria; variability in treatment or control interventions, including differences in dose and timing; variability in management, including co-interventions; differences in outcome measures, such as follow-up times; variation in analysis, such as in handling withdrawals, dropouts and crossovers; variation in quality of design and execution⁴⁸.

In general, JBI systematic reviews combine the results of similar individual studies in a meta-analysis to determine the overall effect of a particular form of health care intervention compared to another standard or control intervention for a specified patient population and outcome⁴⁹. The studies included in this systematic review were examined and differences were found between studies, for example, subtle differences in inclusion criteria, variability in treatments, and differences in follow-up times were identified (Appendix III). In a narrow approach of meta-analysis, it would be problematic to perform a meta-analysis of diverse studies in order to generate useful and clinically applicable information. In a meta-analysis where the types of interventions, types of participants, and the medical context of all the studies included in the meta-analysis are the same, and where study quality is uniformly good (low risk of biases), as is typical of JBI systematic reviews, a meta-analysis would generate useful and clinically applicable information⁵⁰ in order to provide clear recommendations for practice. The clinical interpretability of the results of meta-analysis can be compromised in meta-analyses where there were different types of participants, interventions, or medical contexts⁵⁰. The general purpose of a meta-analysis, however, is to answer broader questions than the individual studies⁵¹. When the question posed involves the applicability of a class effect of a treatment a more broadly focused meta-analysis may be needed, at the expense of precision, in order to generalize the results to a broader population⁴⁸.

Even though it is apparent there is some clinical heterogeneity between the studies included in this systematic review, the decision to combine them in a meta-analysis is justified for a number of reasons. First, heterogeneous results are expected in systematic reviews because they incorporate studies that are diverse clinically and methodologically³¹. Second, it is necessary to determine the overall effect of transitioning of care interventions on readmission rates. Third, as the question is to determine if transitioning of care interventions work, and not the effect size per se, the authors have chosen to proceed with the assumption that it is acceptable to combine varied studies. This decision was associated with an assumed impact on clinical interpretability of the results. The included studies differ in the types of participants, the types of interventions, and the duration of follow-up; therefore, there may be different effect sizes underlying these different studies. The assumption was that not all studies in the meta-analysis share a common true effect size but that the true effect size may vary from study to study. A meta-analysis combining studies based on method of post-discharge follow-up using a random-effects meta-analysis model, based on guidance provided in the meta-analysis literature⁵², was conducted. The decision was made to perform a meta-analysis with an overall intent not to estimate a true common effect of nurse mediated transitioning of care interventions, but to estimate the mean of a distribution of effects of this class of interventions. This is done based on the assumption that any intervention to decrease rates of readmission in HF is better than no intervention at all.

Six studies were identified that evaluated transitioning of care interventions using only telephone calls as a means of post discharge follow-up on readmission rates^{33,38-40,42,47}. One study, McDonald³⁹, reports the preliminary, 30-day results of the McDonald⁴⁰ study. This study³⁹ was not included in the final meta-analyses to avoid double counting of patient events. An initial meta-analysis on the five remaining studies showed moderate evidence of statistical heterogeneity ($\text{Chi}^2 = 9.40$ [$P = 0.05$], $I^2 = 57\%$). McDonald⁴⁰ was excluded from the meta-analysis on the basis of the study's requirements for patients to meet strict criteria for clinical stability prior to discharge. These requirements were not found in other studies. McDonald⁴⁰ was the only study in this group to have results significantly favouring the intervention group (relative risk 0.08, 95% CI 0.01, 0.62; absolute risk reduction 21%). The combination of clinical stability and a transitioning of care intervention likely contributed to the largely favourable outcomes in the experimental group.

A meta-analysis on the four remaining studies that utilised telephone calls as the means for post discharge follow-up on readmission rates^{33,38,42,47} demonstrated results that favoured the control group (relative risk 1.06, 95% CI 0.95, 1.19). There was no statistically significant heterogeneity ($\text{Chi}^2 = 0.777$ [$P = 0.8826$], $I^2 = 0\%$). There was a 2% increase in absolute risk for his type of intervention (Appendix IV).

There were three studies evaluating the effects on readmission rates with a transitioning of care intervention using structured home visits as the method of post discharge follow up^{37,41,45}. This type of intervention showed a statistically significant relative risk of 0.80 (95% CI 0.66, 0.96) and no statistically significant heterogeneity ($\text{Chi}^2 = 0.12$ [$P = 0.9418$]; $I^2 = 0\%$). This group had an absolute risk reduction of 12%. All three studies demonstrated a reduction in readmission rates; however, their individual results were not statistically significant (see Appendix IV).

Seven studies^{33,34-36,43,44,46} comprised the home visit with telephone follow-up category. Overall, this type of intervention showed a relative risk of 0.86 (95% CI 0.74, 0.98) with no evidence of statistically significant heterogeneity by Chi^2 (10.42, $P = 0.1080$) but a low level of heterogeneity by I^2 (41%). This type of intervention had an absolute risk reduction of 4% (Appendix IV). Six^{32,34,35,43-45} of these studies demonstrated nurse coordinated transitioning of care interventions that reduced readmission rates for patients with HF, but only one was statistically significant⁴⁴ (Appendix IV). Jaarsma³⁶ was the only study in this group to show results favouring the usual care group, though these results were not statistically significant (relative risk 1.06, 95% CI 0.92, 1.21; increased absolute risk of 3%). This may have been due to the extended time period, 18 months, before readmissions were measured and the inability of this 30-day intervention to sustain positive outcomes out to this duration of follow-up. While the Rich⁴³ pilot study did demonstrate a reduction in readmission rates those results were not statistically significant (relative risk 0.73, 95% CI 0.44, 1.20; absolute risk reduction 13%), the follow-up study⁴⁴ of this intensive intervention was the only study in this group that demonstrated a statistically significant reduction in readmission rates (relative risk 0.69, 95% CI 0.50, 0.95; absolute risk reduction of 13%). The remaining four studies^{32,34,35,46} in this group showed that the transitioning of care interventions used could reduce readmission rates for patients with HF, although their results were not statistically significant.

Discussion

The findings of this review suggest that nurse coordinated transitioning of care interventions for patients with HF discharged from the hospital to home can demonstrate a reduction in readmission rates. All interventions began in the inpatient setting and included evaluation and education by a nurse or APN. The care continued in the home setting as telephone contact, home visits, or

combination of both interventions. The number of contacts varied across studies from two to greater than 20. The post discharge interventions varied between studies with initiation as soon as 24 hours post discharge and continuing for up to 12 months.

A nurse coordinated team providing multiple interventions combining home visits with telephone follow up, reduced hospital readmissions^{32,34,35,43,44,46}. In evaluating the intensity of the intervention, it was noted that frequency of contacts, the use of multidisciplinary consultations, continuity of care between the inpatient and outpatient setting and specialised training of the healthcare provider, are likely to strengthen the effects of the intervention. When the duration of the transitioning of care interventions that included at least one home visit exceeded 30 days^{32,36,37,41,43,44,46} a compounding effect may have supported the readmission reduction. One study³⁶ in the combined intervention did not support these findings. This could be explained by the inability of this brief intervention to sustain results out to the 18-month follow-up period utilised in this study.

The risk of readmissions can be reduced if multidisciplinary services and follow-up care are initiated before discharge from the hospital. This process can achieve improved health outcomes while the patient with HF is transitioning to home. There were five studies^{36,38,40,43,44} that described interdisciplinary consultations (including dietary, physical therapy, and social work) as part of the intervention. Four studies^{36,38,43,44} described inpatient consultations from two or more of these disciplines. Three^{40,43,44} of the five studies support collaboration with an interdisciplinary team for patients' discharge preparation.

While telephone follow up alone did not show a reduction in readmission rates overall, McDonald^{39,40} demonstrated the importance of clinical stability and maximisation of medical therapy. By adhering to strict guidelines for clinical stability and optimising medical therapy prior to discharge for all patients in this study, zero readmissions were demonstrated in both the intervention and control groups at 30 days³⁹. Weekly telephone follow up for three months demonstrated a significant reduction in readmission rates in the intervention group out to three months post discharge⁴⁰.

Continuity of care and strengthening of the patient/nurse bond may add to the intensity of the intervention and factor into the reduction of readmission rates. Of the eight studies^{32,35,36,41,43-46} reviewed where the same nurse followed the patient from hospital to home; all except one³⁵ identified a reduction in readmission rates.

The more expertise the nurse has in caring for the complex needs of patients with HF the greater the likelihood the intervention will be successful in reducing readmission rates. In the 10 studies^{32,35,36,38,40-44,46} reviewed where the nurse was identified as having additional expertise in cardiovascular or HF care, seven^{32,35,40,41,43,44,46} identified a reduction in readmission rates.

Limitations of the review

There were a few limitations in this review. Many of the studies included were conducted on small samples. This may reduce the reliability of the results. The clinical heterogeneity between the studies could suggest that the effect size may differ according to the intensity of the intervention and duration of follow-up. While unexplained heterogeneity may weaken the results, the authors believe this systematic review provides useful information for stakeholders concerned with reducing readmission rates for patients with HF.

The studies were conducted mainly on older adults with HF. This limits the generalisability of the findings to younger patients with HF. Additionally, the latest study identified was published in 2008. There is a lack of current research on this topic.

Conclusions

The findings of this review suggest that nurse coordinated transitioning of care interventions for patients with HF discharged from the hospital to home can demonstrate a reduction in readmission rates. Improved outcomes are seen in interventions carried out by a HF trained nurse who conducts at least one home visit and follows the patient at least weekly for a minimum of 30 days post discharge with either additional home visits or telephone contact.

Discharge planning for the patient with HF requires a multi-faceted approach to enable patient self-care. A multidisciplinary focus on the patient's needs and other comorbidities can benefit the patient and promote continuity to improve outcomes. The findings of this systematic review can facilitate and assist health care providers with preventing hospital readmissions by promoting effective transitioning of care interventions in the hospital and post discharge for patients with HF.

Implications for practice

As the number of patients with HF continues to grow and readmissions rise, this review supports the development of a nurse coordinated transitioning of care plan with inpatient assessment and education from a multidisciplinary team followed by at least one home visit and weekly contact by telephone or additional home visits by a nurse for a minimum of 30 days post discharge to reduce readmission rates in this population.

Standardising transitioning of care will require changes in health policy. There is a need to improve communication during transitions between providers, patients and caregivers, and between care sites. Electronic medical records could be utilised to provide shared access between inpatient and outpatient providers. Each member of the transitioning team will have to have a clear understanding of the expectations and their role in the process. Payment systems that align incentives and performance measures need to be developed and implemented to encourage transitioning of care⁵³.

Implications for research

This review underscores the need for continued research on the effect of the intensity and duration of the transitioning of care intervention on hospital readmission rates in a well designed large RCT with an adult population with HF to determine the ideal frequency and duration of the post discharge interventions. Future research should also examine the effect of APNs as team leaders in transitioning of care.

Conflicts of interest

No relationships to disclose.

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Appendix I: Appraisal instruments

JBI Critical Appraisal Checklist for Experimental Studies

Reviewer _____ Date _____
 Author _____ Year _____ Record Number _____

	Yes	No	Unclear
1. Was the assignment to treatment groups truly random?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Were participants blinded to treatment allocation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Was allocation to treatment groups concealed from the allocator?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Were the outcomes of people who withdrew described and included in the analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Were those assessing outcomes blind to the treatment allocation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Were the control and treatment groups comparable at entry?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Were groups treated identically other than for the named interventions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Were outcomes measured in the same way for all groups?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Were outcomes measured in a reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Was appropriate statistical analysis used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal: Include Exclude Seek further info.

Comments (Including reasons for exclusion)

Appendix II: Data extraction instruments

JBI Data Extraction Form for Experimental/Observational Studies

Reviewer _____	Date _____
Author _____	Year _____
Journal _____	Record Number _____

Study Method

RCT Quasi-RCT Longitudinal

Retrospective Observational Other _____

Participants

Setting _____

Population _____

Sample size _____

Intervention 1 _____ Intervention 2 _____ Intervention 3 _____

Interventions

Intervention 1 _____

Intervention 2 _____

Intervention 3 _____

Clinical outcome measures

Outcome Description	Scale/measure

Study results

Dichotomous data

Outcome	Intervention () number / total number	Intervention () number / total number

Continuous data

Outcome	Intervention () mean & SD (number)	Intervention () mean & SD (number)

Authors Conclusions

Comments

Appendix III: Description of included trials

Transitioning of Care Interventions

A. Telephone Interventions

Study, Design (Country)	Mean Age, y (SD)	HF status: LVEF (SD) %; NYHA class	Transitioning of care intervention †	Transitioning of care sample size, No.	Usual care sample size, No.	Duration of intervention	Timing of readmission measurement	Results, Relative risk (95% CI)
Debusk et al., 2004 ³³ , RCT (U.S.)	72 (11)	NYHA I-II (51%), III-IV (49%)	1-hour education session with a nurse prior to discharge. Telephone follow-up by a nurse care manager under physician direction occurred weekly for 6 weeks, every other week for 8 weeks, monthly for 3 months, then bimonthly for 6 months.	228	234	12 months	12 months	1.02 (0.85, 1.22)
Laramée et al., 2003 ³⁸ , RCT (U.S.)	70 (12)	80% with moderate to severely reduced LVEF; NYHA I-IV (38% class III-IV)	Early discharge planning and daily inpatient education by HF case manager (Master's prepared); social work, dietary and physical therapy consults. Telephone follow-up 1-3 days post discharge, weekly for 4 weeks, and then biweekly for 8 weeks.	131	125	3 months	3 months	1.02 (0.74, 1.40)
McDonald et al., 2001 ³⁹ , RCT (Ireland) [*preliminary (30 day) results of McDonald et al., 2002]	69 (12)	LVEF 39 (13)	HF nurse specialist education session and dietary consult 3 or more times during admission. Telephone contact by same nurse who saw patient in hospital at 3 days post discharge and then weekly for 12 weeks, (optimization of medical therapy and prerequisites for discharge established to assure stability at discharge for both groups).	35	35	1 month	1 month	No readmissions in either group. Relative risk was not estimatable.
McDonald et al., 2002 ⁴⁰ , RCT (Ireland)	71 (10)	LVEF 37 (13)	HF nurse specialist education session and dietary consult 3 or more times during admission. Telephone contact by same nurse who saw patient in hospital at 3 days post discharge and then weekly for 12 weeks, (optimization of medical therapy and prerequisites for discharge established to assure stability at discharge for both groups).	51	47	3 months	3 months	0.08 (0.01, 0.62)
Nucifora et al., 2006 ⁴² , RCT (Italy)	73 (9)	LVEF 43 (17); NYHA I-IV (64% class III-IV)	30 minute inpatient education session with cardiovascular nurse. Telephone follow up by nurse within 3-5 days of discharge.	99	101	<1 week	6 months	1.14 (0.84, 1.54)
Weinberger et al., 1996 ⁴⁷ , RCT (U.S.)	63 (11)	NYHA I-IV (half class III-IV)	Inpatient visit 3 days before discharge by nurse and 2 days before discharge by primary physician. Single telephone call by nurse 2 days post discharge.	249	255	< 1 week	6 months	1.11 (0.92, 1.33)

B. Home Visit Intervention

Study, Design (Country)	Mean Age (SD), y	HF status: LVEF % (SD); NYHA class	Transitioning of care intervention †	Transitioning of care sample size, No.	Usual care sample size, No.	Duration of intervention	Timing of readmission measurement	Results, Relative risk (95% CI)
Kwok et al., 2008 ³⁷ , RCT (Hong Kong)	78 (7)	LVEF <40 (23)	Inpatient counselling by community nurse; 1 home visit by nurse within 1 week of discharge and weekly for 4 weeks then monthly for 5 months.	49	56	6 month	6 month	0.83 (0.53, 1.28)
Naylor et al., 2004 ⁴¹ , RCT (U.S.)	76 (7)	90% with LVEF <45	Daily in hospital contact by HF trained advanced practice nurse beginning within 24 hours of admission; home visit within 24 hours of discharge then weekly for the first month and bimonthly for second and third month with additional visits scheduled as needed (minimum of 8 home visits).	118	121	3 months	12 months	0.81 (0.63, 1.05)
Stewart et al., 1998 ⁴⁵ , RCT (Australia)	75 (11)	LVEF 39 (11); NYHA II-IV	Inpatient counselling by nurse. Single home visit by nurse and pharmacist 1 week post discharge.	49	48	1 week	6 months	0.76 (0.53, 1.08)

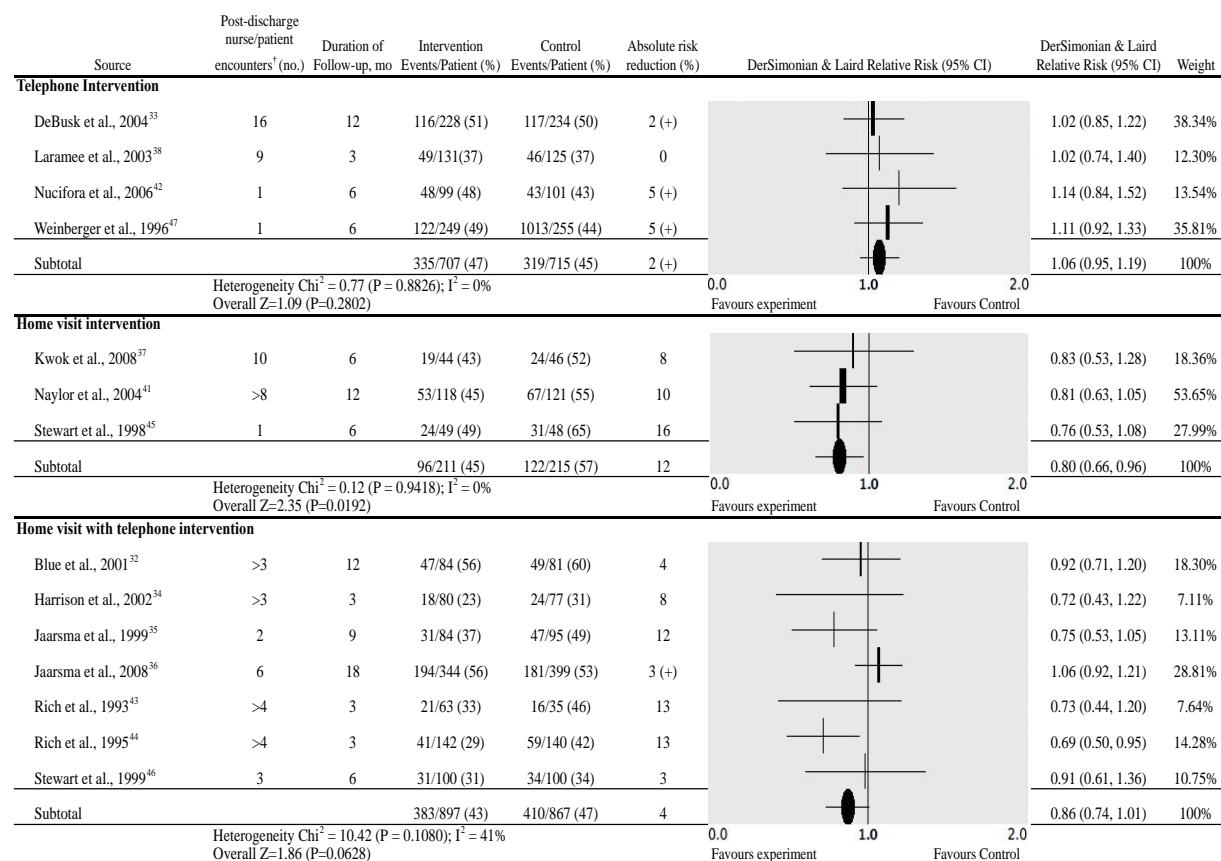
C. Home Visits with Telephone Interventions

Study, Design (Country)	Mean Age, y (SD)	HF status: LVEF % (SD); NYHA class	Transitioning of care intervention †	Transitioning of care sample size, No.	Usual care sample size, No.	Duration of intervention	Timing of readmission measurement	Results, Relative risk (95% CI)
Blue et al., 2001 ³² , RCT (United Kingdom)	75 (8)	NYHA II-IV	Inpatient education plus a number of planned home visits by a specialist nurse supplemented with telephone contact as needed (the actual number of encounters not specified by authors).	84	81	1 year	1 year	0.92 (0.71, 1.20)
Harrison et al., 2002 ³⁴ , RCT (Canada)	76 (10)	NYHA I-IV (77%-class III-IV)	Inpatient education and counselling protocol, one telephone call by hospital nurse made to patient within 24 hours of discharge, and a minimum of 2 home visits by visiting nurse within 2 weeks of discharge.	80	77	2 week	3 months	0.72 (0.43, 1.22)
Jaarsma et al., 1999 ³⁵ , RCT (the Netherlands)	73 (9)	LVEF 34.4 (14), NYHA III-IV	Inpatient education by study nurse, telephone call by study nurse to patient within 1 week of discharge, and 1 home visit within 10 days of discharge.	84	95	10 days	9 months	0.75 (0.53, 1.05)
Jaarsma et al., 2008 ³⁶ , RCT (the Netherlands)	71 (11)	LVEF 34 (14), NYHA II-IV	Inpatient education by a HF nurse; advice provided by physical therapist, dietician, and social worker. Weekly telephone follow-up and 2 home visits by a HF nurse over first month post-discharge; as well as additional HF nurse visits in an outpatient clinic.	344	339	1 month	18 months	1.06 (0.92, 1.21)
Rich et al., 1993 ⁴³ , RCT (U.S.)	79(6)	LVEF <50 in 44 of 73 patients measured (60%); mean NYHA III (1)	Daily inpatient visits by cardiac nurse, dietary and social service consults, and medication review by geriatric cardiologist. Home visit within 48 hours of discharge by visiting nurse service and 2 more visits within first week then at regular intervals per home care guidelines, in addition to regular telephone contact by cardiac nurse.	63	35	3 months	3 months	0.73 (0.44, 1.20)
Rich et al., 1995 ⁴⁴ , RCT (U.S.)	79 (6)	LVEF 43 (14); mean NYHA 2.4 (1)	Daily inpatient visits by cardiac nurse, dietary and social service consults, and medication review by geriatric cardiologist. Home visit within 48 hours of discharge by visiting nurse service and 2 more visits within first week then at regular intervals per home care guidelines, in addition to regular telephone contact by cardiac nurse.	142	140	3 months	3 months	0.69 (0.50, 0.95)
Stewart et al., 1999 ⁴⁶ , RCT (Australia)	75 (8)	LVEF 37 (11); NYHA II-IV	Inpatient contact with cardiac rehabilitation nurse, dietician, social worker, pharmacist, and community nurse. 1 home visit by a cardiac nurse 7-14 days post discharge, (home visit repeated if patient had 2 or more unplanned readmissions within 6 months of index hospitalization). The nurse contacted patient by telephone at 3 months and 6 months.	100	100	6 months	6 months	0.91 (0.61, 1.36)

Abbreviations: CI, confidence interval; HF, heart failure; LVEF, left ventricular systolic function; no, number; NYHA, New York Heart Association; RCT, randomized controlled trial; SD, standard deviation; U.S., United States; y, year

† Transitioning of care interventions were compared with usual care in each study; usual care was poorly defined by study authors.

Appendix IV: Meta-analysis of readmission rates comparing transiting of care interventions to usual care*



Abbreviations: CI, confidence interval; mo, month; no, number; (+), increased risk
[†]Percentages and events are subject to rounding error. [†]All interventions included inpatient heart failure education.

Appendix V: Excluded studies and reasons for exclusion

Anderson C, Deepak BV, Amoateng-Adjepong Y, Zarich S. Benefits of comprehensive inpatient education and discharge planning combined with outpatient support in elderly patients with congestive heart failure. *Congestive Heart Failure*. 2005;11(6):315-21.

Reason for exclusion: Quasi-experimental design.

Brand CA, Jones CT, Lowe AJ, Nielsen DA, Roberts CA, King BL, et al. A transitional care service for elderly chronic disease patients at risk of readmission. *Australian Health Review*. 2004;28(3):275-84.

Reason for exclusion: Heart failure specific data could not be extracted.

Capomolla S, Febo O, Ceresa M, Caporotondi A, Guazzotti G, La Rovere MT, et al. Cost/Utility ratio in chronic heart failure: Comparison between heart failure management program delivered by day-hospital and usual care. *Journal of the American College of Cardiology*. 2002;40(7):1259-66.

Reason for exclusion: Not a transitioning of care.

Cline CM, Israelson BY, Willenheimer RB, Broms K, Erhardt LR. Cost effective management programme for heart failure reduces hospitalization. *Heart*. 1998;80(5):442-6.

Reason for exclusion: Not a transitioning of care.

DelSindaco D, Pulignano G, Minardi G, Apostoli A, Guerrieri L, Rotoloni M, et al. Two-year outcome of a prospective, controlled study of a disease management programme for elderly patients with heart failure. *Journal of Cardiovascular Medicine*. 2007;8(5):324-9.

Reason for exclusion: Not a transitioning of care.

Duffy JR, Hoskins LM, Dudley-Brown, S. Improving outcomes for older adults with heart failure: A randomized trial using a theory-guided nursing intervention. *Journal of Nursing Care Quality*. 2010;25(1):56-64.

Reason for exclusion: Not a transitioning of care.

Grancelli H, Varini S, Ferrante D, Schwartzman R, Zambrano C, Soifer S, et al. Randomized trial of telephone intervention in chronic heart failure (DIAL): Study design and preliminary observations. *Journal of Cardiac Failure*. 2003;9(3):172-9.

Reason for exclusion: Not a transitioning of care.

Inglis SC, Pearson S, Treen S, Gallasch T, Horowitz JD, Stewart S. Extending the horizon in chronic heart failure: Effects of multidisciplinary, home-based intervention relative to usual care. *Circulation*. 2006;114(23):2466-73.

Reason for exclusion: Secondary analysis of two prior studies evaluating long term effect of intervention.

Krantz MJ, Havranek EP, Haynes DK, Smith I, Bucher-Bartelson B, Long CS. Inpatient initiation of Beta-blockade plus nurse management in vulnerable heart failure patients: A randomized study. *Journal of Cardiac Failure*. 2008;14(4):303-9.

Reason for exclusion: Not a transitioning of care.

Krumholz HM, Amatruda J, Smith GL, Mattera JA, Roumanis SA, Radford MJ, et al. Randomized trial of an education and support intervention to prevent readmission of patients with heart failure. *Journal of the American College of Cardiology*. 2002;39(1):83-9.

Reason for exclusion: Not a transitioning of care.

Ledwidge M, Ryan E, O'Loughlin C, Ryder M, Travers B, Kieran E, et al. Heart failure care in a hospital unit: a comparison of standard 3-month and extended 6-month programs. *The European Journal of Heart Failure*. 2005;7(3):385-91.

Reason for exclusion: Comparison of a transitioning of care intervention with three months of post discharge follow up (control group) to one with six months of post discharge follow up (intervention group). No comparison was made to usual care.

Lewis BE, O'Mara P, Pezzella S. The development and implementation of a disease management program in a managed care setting. *Annals of Long-Term Care*. 1999;7(6):226-32.

Reason for exclusion: Not a transitioning of care.

Naylor M, Brooten D, Jones R, Lavizzo-Mourey R, Mezey M, Pauly M. Comprehensive discharge planning for the hospitalized elderly. *Annals of Internal Medicine*. 1994;120:999-1006.

Reason for exclusion: Heart failure specific data could not be extracted.

Naylor MD, McCauley KM. The effects of a discharge planning and home follow-up intervention on elders hospitalized with common medical and surgical cardiac conditions. *The Journal of Cardiovascular Nursing*. 1999;14(1):44-54.

Reason for exclusion: Secondary analysis of a prior study.

Naylor MD, Brooten D, Campbell R, Jacobsen BS, Mezey MD, Pauly MV, et al. Comprehensive discharge planning and home follow-up of hospitalized elders. *Journal of the American Medical Association*. 1999;281(7):613-20.

Reason for exclusion: Heart failure specific data could not be extracted.

Oddone EZ, Weinberger M, Giobbie-Hurder A, Landsman P, Henderson W. Enhanced access to primary care for patients with congestive heart failure. *Effective Clinical Practice*. 1999;2(5):201-9.

Reason for exclusion: Secondary analysis of a prior study.

Rauh RA, Schwabauer NJ, Enger EL, Mora JF. A community hospital-based congestive heart failure program: Impact on length of stay, Admission and Readmission Rates, and Cost. *American Journal of Managed Care*. 1999;5:37-43.

Reason for exclusion: Quasi-experimental design.

Riegel B, Carlson B, Kopp Z, LePetri B, Glasser D. Effect of a standardized nurse case-management telephone intervention on resource use in patients with chronic heart failure. *Archives of Internal Medicine*. 2002;162(6):705-12.

Reason for exclusion: Not a transitioning of care.

Stewart S, Horowitz J. Home-based intervention in congestive heart failure: Long-term implications on readmission and survival. *Circulation*. 2002;105(24):2861-6.

Reason for exclusion: Secondary analysis of two prior studies evaluating the long term effects of the intervention.

Stewart S, Horowitz J. Detecting early clinical deterioration in chronic heart failure patients post-acute hospitalisation-a critical component of multidisciplinary, home-based intervention? *The European Journal of Heart Failure*. 2002;4(3):345-51.

Reason for exclusion: Secondary analysis of a prior study.

Stewart S, Vandebroek AJ, Pearson S, Horowitz JD. Prolonged beneficial effects of a home-based intervention on unplanned readmissions and mortality among patients with congestive heart failure. *Archives of Internal Medicine*. 1999;159(3):257-61.

Reason for exclusion: Secondary analysis of a prior study evaluating the long term effects of the intervention.