International Journal of Integrated Care
ISSN 1568-4156
Volume 12, 10 August 2012
Publisher: Igitur publishing
URL:http://www.ijic.org
URN:NBN:NL:UI:10-1-113107 / ijic2012-132

Submitted: 5 January 2012, revised 15 May 2012, accepted 20 May 2012

Research and Theory

# Transitional care programs: who is left behind? A systematic review

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## Abstract

**Objective:** Older adults are at risk of rehospitalization if their care transitions from hospital-to-home are not properly managed. The objective of this review was to determine if older patient populations recruited for randomized controlled trials of transitional care interventions represented those at greatest risk of rehospitalization following discharge. Relevant risk factors examined were cognitive impairment, depression, polypharmacy, comorbidity, length of stay, advanced non-malignant diseases, and available social support.

**Design:** Systematic review.

**Setting:** Hospital to home.

**Participants:** Older hospitalized adults.

**Measurements:** For inclusion, articles were required to focus on hospital-to-home transitions with a self-care component, have components occurring both before and after discharge, and a randomized controlled trial design. Articles were excluded if participants had a mean age under 55 years, or if interventions focused on developmental disabilities, youth, addictions, or case management, or were solely primary-care based.

**Results:** Following title, abstract, and full review by two authors, 17 articles met inclusion criteria. Risk factors for rehospitalization were often listed either as exclusion criteria or were not reported at baseline by the studies. One study included patients with all identified risk factors for rehospitalization.

**Conclusions:** These data suggest that published studies of transitional care interventions do not often include older adults at highest risk of rehospitalization, raising concerns about the generalizability of their results. Studies are needed that evaluate interventions that explicitly address the needs and characteristics of these patients.

## Keywords

**systematic review, care transitions, self-care, comorbidity, rehospitalization**

## Introduction

With population aging, many countries are facing increased pressures on health care resources. Older adults with chronic disease are the fastest growing segment of the population and the heaviest health care users, accounting for up to four times more hospital days than the rest of the population [1]. In order to address hospital bed overflow, hospitals are discharging patients earlier with the expectation that a portion of their care will take place in the next care setting. For older patients with multiple chronic conditions that require close follow-up, early discharge may be associated with an increased risk of rehospitalization.

Care transitions across different health care settings may be particularly problematic for vulnerable older adults, who may be at risk for poor health outcomes or worsening of their conditions [2–8]. Care fragmentation leaves patients and their caregivers unprepared to manage their conditions following hospital discharge [3, 9], leading to greater use of hospital, emergency, post-acute and ambulatory services [8, 10]. Nearly one-quarter of older patients discharged from the hospital experience an adverse health outcome such as rehospitalization within 30 days [11]. Rehospitalizations place older adults at risk for further health declines that threaten functional independence and quality of life, and that may lead to unnecessary hospital bed use, premature institutionalization, and costs to the health care system [11–13].

Transitional care interventions are designed to address the need for better care coordination, recognizing that patients and their caregivers are the common factors across care settings and therefore key players in care transition management [3]. Hospital-to-home transitions require that patients acquire self-care skills for conditions that are either newly diagnosed or that have recently worsened [10, 14]. Self-care aims to improve health outcomes and prevent unnecessary hospitalization [15] through symptom management and promotion of lifestyle, physical and psychosocial changes that are necessary to manage their conditions [14]. Self-care skills are essential for community-dwelling patients who may not have access to ongoing nursing support. Current literature suggests that transitional care interventions based on self-care skills may be an effective solution for improving patient and system outcomes [2, 5, 16–19].

Risk factors for rehospitalization include older age, inadequate support systems, multiple comorbidities, polypharmacy, depression, functional impairment, low self-health rating, and history of non-adherence [3, 20–28]. For transitional care interventions to be most effective, they must target patients at risk of unplanned rehospitalization. An article recently published by Naylor [20] suggests that discharge planning and follow-up procedures used in some transitional care interventions focus on patients with single conditions, and are thus not targeting older patients with complex multiple conditions. Care interventions need to address the complex needs of at-risk older adult patients while ensuring continuity of care in a diverse range of settings and across providers [20], rather than treating patient conditions in isolation. The objective of this review is to determine if patients included in studies of transitional care interventions are truly at high risk for rehospitalization.

## Methods

All relevant English language articles published up to and including August 2011 were considered for this review. Criteria to establish article relevance are defined below.

*Inclusion criteria:*

1. Randomized controlled trials of transitional care interventions for patients moving from hospital to home.
2. Self-care was an integral component of interventions studied [8, 15].
3. Interventions included components occurring both before and after hospital discharge.
4. Trials assessed the efficacy of interventions on patient and/or system outcomes (e.g. rehospitalizations, emergency department visits, mortality, home visits, costs, care transition quality, satisfaction, mortality, quality of life, falls, adherence to treatment, service use, and cost).

*Exclusion criteria:*

1. Study populations had a mean age under 55 years [29].
2. Articles describing transitional care interventions designed exclusively for developmental disabilities, youth and/or addictions.
3. Articles describing programs that focused exclusively on providing patient and/or system management (e.g. case management interventions).
4. Articles describing programs based solely in primary care [30].

For the purpose of this review, transitional care interventions were defined as a structured set of services to enhance the health, safety, and continuity of care for patients moving from hospital to home [20, 23]. We chose to focus on community-dwelling seniors, rather than long-term care residents, as they make up the majority of older adults discharged from hospital and for whom the acquisition of self-care skills is a reasonable expectation [22, 24]. Self-care was defined as "enhancing the ability of patients and informal caregivers to manage chronic illness, including learning to recognize and

manage disease exacerbations and access the system early enough to avert acute care use" [15]. Although discharge planning is a vital part of successful care transitions, we will focus on models with components before and after hospital discharge [2].

Articles were retrieved from Medical Literature Analysis and Retrieval System Online (Medline), Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Embase for all available years up to and including August 2011. Search strings were tested using previously identified relevant articles and are included in Appendix A. Article titles and abstracts were reviewed for relevance based on the inclusion and exclusion criteria listed above. Relevant articles were independently reviewed by two authors, with a third reviewer adjudicating in the case of disagreement. For each article selected, information was gathered and summarized in two tables. A list of risk factors that should be considered when assessing the real-world generalizability of transitional care interventions was developed based on a review of the literature [20–28]. This list was used to gauge whether articles reviewed targeted patients with risk factors for rehospitalization following hospital discharge, including:

1. Comorbidity: occurrence of two or more medically diagnosed conditions [22, 24];
2. Polypharmacy: concurrent use of two or more drugs [25];
3. Cognitive impairment of any severity [24, 26, 28];
4. Depression [27, 28];
5. Inadequate social support [20, 21]; and
6. Patients with advanced non-malignant diseases [31, 32].

Information was abstracted from each of the reviewed articles including study population characteristics, components of the interventions, outcome measures, and risk factors for rehospitalization, including risk factors that were: 1) directly specified; or 2) not specified but present among participants included in each study.

# Results

## Summary of search results

After removing duplicates, the initial key word search identified 5882 articles (Figure 1). Based on the above criteria, 163 studies were identified as relevant based on title and abstract content and were reviewed by two authors (EP and CG), yielding a final list of 17 articles.

Summary information for each article including participant selection criteria, baseline characteristics, and components of each transitional care intervention can be found in Appendix B. Six studies were completed

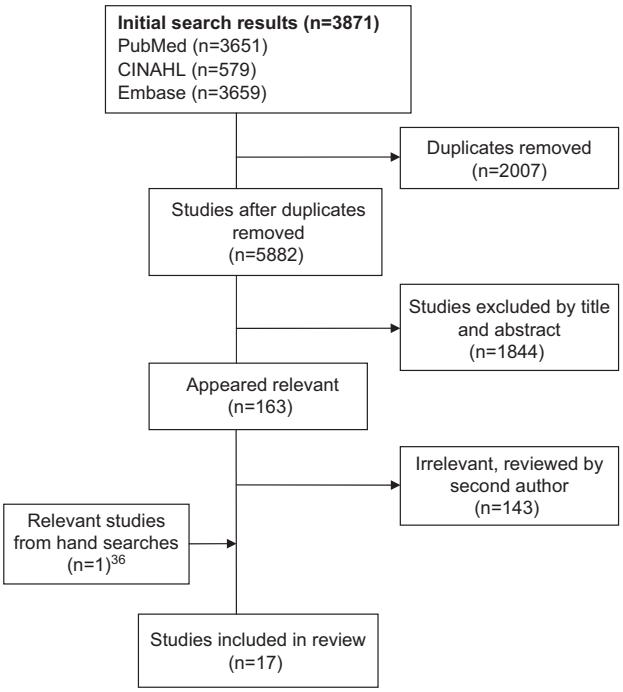


**Figure 1.** Results of Search Strategy. This figure describes how articles were chosen from our initial search.

in the US, four in Europe (Spain, Ireland, Netherlands, and UK), two in Canada, and two in Asia (Taiwan and Hong Kong). Nine articles specifically targeted older patients [2, 6, 18, 33, 34], ten articles focused on patients with heart failure, and one article focused on patients with hip fracture. The mean age of the participants in the intervention group range from 69 years to 79 years across studies. For a summary of risk factors targeted by each intervention, see Table 1. Table 2 summarizes the characteristics of the study population by article.

## Cognitive impairment and depression

One [35] of the fifteen studies explicitly reported on cognitive status and depression in their sample at baseline. Eight [2, 6, 17, 18, 36–38] studies excluded patients with cognitive impairment and three [16, 34, 39] excluded those with dementia. Fourteen studies did not provide data on depression and three did not report on cognitive impairment or dementia [18, 33, 40].

## Comorbidities

Three articles [2, 5, 35] specifically targeted participants with two or more comorbid conditions. Two studies [17, 35] provided information on the number of comorbid conditions in the sample at baseline; the remaining articles either did not provide data on the comorbid status of their participants or did not include participants with more than one diagnosed condition.

**Table 1.** Summary of key study characteristics and targeted risk factors for hospitalization

| Criteria/characteristic | Number/characteristics of articles |
|---|---|
| Country for study | US (6), Canada (2), Spain, Ireland, Netherlands, UK, Taiwan, Hong Kong |
| Disease focus | Heart failure (10), hip fracture (1), general medical/geriatrics (14) |
| Mean age of participants | 69–79 years of age |
| Cognitive impairment and depression | Information provided on baseline cognitive impairment/depression (1)<br>Excluded cognitive impairment (8) or dementia (3)<br>No data provided on depression (14)<br>No data on cognitive impairment (3) |
| Comorbidities (Two or more chronic conditions) | Studies targeting patients with ≥2 comorbidities (3)<br>Information provided on number of comorbidities (2)<br>No information provided on comorbidities/excluded patients with comorbidities (10) |
| Polypharmacy (Two or more medications) | Specifically targeting polypharmacy (1)<br>Information provided on mean number of medications (3)<br>No data provided on medications (4)<br>Reported on condition-specific medications (e.g. for heart-failure) (7) |
| Social support | Study targeted/included patients living alone or little social support (9) |
| Hospice/Palliative (Non-malignant advanced) | Excluded hospice/palliative patients (10) |

## Polypharmacy

One study [35] specifically targeted patients taking two or more medications; three of the remaining articles [2, 5, 17] reported the mean number of medications taken by the participants at baseline. Four of the articles did not provide [6, 18, 33, 34] any data on number of medications taken by their study population and the remaining articles reported on the proportion of the study population currently prescribed specific types of medications (usually those related to heart failure and other cardiac conditions) [16, 19, 36, 38, 39].

## Social support

Nine studies either specifically targeted or included patients living alone or those with little or no social support [2, 5, 6, 19, 35, 36, 38, 40, 41]. Conversely, 96.8% of the sample used by Huang and Liang [18] lived with family, and in the study by Zhao and Wong [34], one % of participants lived alone.

## Advanced non-malignant disease

Ten studies excluded patients requiring hospice-palliative care or with a life-expectancy estimated at <3 to 6 months who had non-malignant diseases [6, 16–19, 35–39].

In summary, four [2, 5, 17, 35] of the studies reviewed targeted and/or included study participants with three or more risk factors for rehospitalization, while the remaining ten explicitly included at most one risk factor. Three interventions [2, 6, 35] included patients with all risk factors though only one [35] study *a priori* defined these criteria explicitly.

# Discussion

Transitional care interventions aim to support patients being discharged from hospital back to the community by focusing on enhancing self-care abilities among patients and caregivers, thus improving health outcomes and preventing unnecessary rehospitalizations. A recent systematic review of published randomized controlled trials suggests that transitional care programs can indeed achieve these goals [42]. We conducted a systematic review of randomized controlled trials of transitional care programs in order to determine how well patients enrolled in these trials correspond to patients known to be at high risk for rehospitalization. Our data suggest that significant differences exist between these patient populations, raising concerns about the generalizability of the interventions studied and their actual potential to improve outcomes among patients at highest risk of rehospitalization.

## Cognitive impairment and depression

An important gap relates to cognitive impairment and depression. These conditions are frequent in older adults and will become increasingly prevalent with population aging [43]. Dementia is a key factor associated with many negative patient and system level outcomes, including incontinence, falls, deconditioning, increased 'alternate level of care' days (acute care days after acute care is no longer needed), greater length of stay and rehospitalization [22, 44–46]. Health

**Table 2.** Summary of participants by study

| Article | Comorbidity | Polypharmacy | Cognitive impairment, dementia, and depression | Lacking social support |
|---|---|---|---|---|
| Arbaje et al., 2009 [33] | No specific targeting in selection criteria. No information was provided. | Reducing medication errors and adverse drug reactions was a goal of the intervention; however, no information was provided on number of medications at baseline. | No specific targeting in selection criteria. No information was provided. | No specific targeting in selection criteria. No information was provided. |
| Atienza et al., 2004 [16] | No specific targeting in selection criteria. History was provided if diabetes (35%), hypertension (54%), ischemic (33%) or valvular heart disease (24%). | No specific targeting in selection criteria. Percentage of patients on each heart-disease medications. No information on any additional medications was provided. | Excluded if diagnosed with dementia or psychiatric illness (~3% of excluded patients). | No specific targeting in selection criteria. Twelve percent of IG˚ were living alone. |
| Coleman et al., 2006 [6] | Participants were required to have one of eleven diagnoses. (Appendix B). | No specific targeting in selection criteria. No exclusive information provided; however, reported mean chronic disease score in IG was 6.8 (SD 3.5). This score includes age, gender and history of dispensed drugs. | Excluded if diagnosed with cognitive impairment or psychiatric conditions were excluded from study; however, patients underwent a cognitive screening test and were allowed to participate if they had failed the test with the presence of a willing proxy. No further information provided. | No specific targeting in selection criteria. 31.0% of IG were reported as living alone and 41.9% of IG were unmarried. |
| Parry et al., 2009 [41] | Participants were required to have one of eleven diagnoses. (Appendix B). | No specific targeting in selection criteria. | Participants were excluded if they were admitted to psychiatric ward of hospital. Patients underwent a cognitive screening test and were allowed to participate if they had failed the test with the presence of a willing proxy. No further information was provided. | No specific targeting in selection criteria. 28.6% of IG reported living alone and 71.4% of IG were reported as being unmarried. |
| Harrison et al., 2002 [17] | No specific targeting in selection criteria. Mean number of comorbidities in IG at baseline was 3.95 (SD 1.94). | No specific targeting in selection criteria. Mean number of medications in IG at baseline was 6.23 (SD 3.08). | Excluded if diagnosed with cognitive impairment based on the short portable mental status exam. No further information was provided. Depression was not reported. | Not specifically targeted, but 59% of participants in IG were reported as unmarried and 50% of participants in IG were reported as living alone. |
| Huang and Liang, 2005 [18] | *No specific targeting in selection criteria. Reported number of comorbidities: 49.2% had one, 15.9% had 2, and 6.3% had 3+.* | No specific targeting in selection criteria. No information was provided. | Excluded if diagnosed with cognitive impairment. No further information was provided. Depression was not reported. | No specific targeting in selection criteria. 96.8% of participants in IG lived with family; 58.7% were widowed. |
| Jaarsma et al., 1999 [37] | Specifically targeted HF patients. Comorbidities were reported but not as a mean number of comorbid conditions. | No specific targeting in selection criteria. No information was provided. | Excluded if diagnosed with psychiatric condition (7% of those excluded. Depression was not reported). | *No specific targeting in selection criteria. Forty-six percent of IG reported being single or widowed, and 8% of IG reported dependent living.* |
| Koehler et al., 2009 [35] | *Specifically targeted, three or more comorbidities as inclusion criteria. Mean score in IG on Charlson (where higher number indicates a more severe condition) was 3.7 (SD 1.1).* | *Specifically targeted, five or more medications regularly as inclusion criteria. Mean number of inpatient medications in IG was 12 (SD 5).* | *No specific targeting in selection criteria; however, baseline 23% of IG with dementia and 23% of with depression.* | *No specific targeting in selection criteria. Twenty percent of participants in IG lived alone.* |

*Table 2.* (continued)

| Article | Comorbidity | Polypharmacy | Cognitive impairment, dementia, and depression | Lacking social support |
|---|---|---|---|---|
| Kwok et al., 2008 [40] | No specific targeting in selection criteria. History was provided if diabetes (29%), chronic obstructive pulmonary disease (8%), hypertension (54%) or heart specific conditions (18+%). | No specific targeting in selection criteria. Percentage of patients on each heart-disease medications. No information on any additional medications was provided. | No specific targeting in selection criteria. No information was provided. | *No specific targeting in selection criteria. 31.0% of IG were reported as living alone.* |
| Laramee et al., 2003 [38] | No specific targeting in selection criteria. History was provided if diabetes (44%), hypertension (71%) or of heart specific risk factors or conditions (23+%). | No specific targeting in selection criteria. Percentage of patients on each heart-disease medications. No information on any additional medications was provided. | Excluded if diagnosed with cognitive impairment. No information was provided. Depression was not reported. | No specific targeting in selection criteria. Thirty-three percent of IG were reported as living alone, 49% of participants were reported as unmarried. |
| McDonald et al., 2002 [36] | No specific targeting in selection criteria. No information was provided. | No specific targeting in selection criteria. Percentage of patients on each heart-disease medications. No information on any additional medications was provided. | Excluded if diagnosed with cognitive impairment (16.2% of those excluded). Depression was not reported. | *No specific target, however, 62.7% of participants in IG reported having no carer available.* |
| Naylor et al., 1999 [5] | *Specifically targeted, chronic health problems as inclusion criteria. Mean number of comorbid conditions in IG was 5.3 (SD 1.8).* | *No specific targeting in selection criteria; however, mean number of medications in IG was 5.3 (SD 2.7).* | No report on cognitive impairment, however, patients who were not 'alert and oriented' were excluded from study. No information provided. No report on depression was provided, however, depression was acceptable as listed in inclusion criteria. | *No specific targeting in selection criteria. Twenty-nine percent of IG participants reported no social support.* |
| Naylor et al., 2004 [2] | *Specifically targeted, chronic health problems as inclusion criteria. Mean number of comorbid conditions in IG was 6.0 (SD 2.5).* | *No specific targeting in selection criteria; however, mean number of medications in IG was 7.0 (SD 3.1).* | No report on cognitive impairment, however, patients who were not 'alert and oriented' were excluded from study. No information provided. No report on depression was provided, however, depression was acceptable as listed in inclusion criteria. | *No specific targeting in selection criteria. Thirty-six percent of IG participants reported no social support.* |
| Thompson et al., 2005 [19] | *No specific targeting in selection criteria. Mean score in IG on Charlson was 2.5 (SD 1.1).* | No specific targeting in selection criteria. Percentage of patients on each heart-disease medications. No information on any additional medications was provided. | No specific targeting in selection criteria. No information was provided. Depression is not mentioned. | No specific targeting in selection criteria. Twenty-eight percent of IG were reported as living alone. |
| Tsuyuki et al., 2004 [39] | No specific targeting in selection criteria. History was provided if diabetes (39%), hypertension (50%) or number of heart specific risk factors or conditions (50+%). | No specific targeting in selection criteria. Percentage of patients on each heart-disease medications. No information on any additional medications was provided. | Excluded if diagnosed with dementia. Twenty-four percent of total exclusions were due to cognitive impairment. Depression was not reported. | No specific targeting in selection criteria. No information was provided. |
| Zhao and Wong, 2009 [34] | No specific targeting in selection criteria. No information was provided. | No specific targeting in selection criteria. No information was provided. | Excluded if diagnosed with psychosis or dementia. No patients who were assessed for eligibility were excluded from study. Depression was not reported. | No specific targeting in selection criteria. One percent of IG were reported as living alone. All participants in IG reported having a caregiver. |

Italicized font indicates that the intervention successfully targeted the group indicated based on our criteria. *Intervention group.

outcomes are even poorer for older patients with concomitant cognitive impairment and depression, particularly during care transitions [46, 47].

## Comorbidities

Similarly, few of the studies reviewed explicitly targeted older patients with multiple co-existing medical conditions, casting doubts about whether transitional care interventions benefit such patients. It is estimated that 65% of adults aged 65–79 and 78% of adults aged 80 and over have two or more comorbidities, with the largest subgroup in each age category consisting of those with four or more chronic conditions [48]. In fewer than half of the studies reviewed did patient characteristics reflect a relevant comorbidity distribution. Many studies that described the comorbid status of their participants only focused on major medical conditions such as hypertension, heart disease, and diabetes mellitus. In many older patients, geriatric syndromes, such as falls, incontinence, disability, weight loss, dizziness, vision and hearing problems, that frequently co-exist with chronic illnesses, were not reported [49]. Geriatric syndromes are associated with a degree of disability comparable to major medical illnesses, and may have a comparable impact on health outcomes [49].

## Polypharmacy

Adverse drug reactions and poor adherence are common concerns associated with polypharmacy, particularly among older patients with multiple comorbidities [50]. Adverse drug events following hospital discharge often reflect poor communication related to medications [51]. Though improved medication management was a frequently stated goal of transitional care studies reviewed, only one explicitly targeted participants taking more than one medication, while over one quarter provided no data on the number of medications prescribed to their study population.

## Social support

Patients with inadequate social support, such as living alone, being unmarried, having irregular family contact, and being home alone for more than two hours daily, were targeted by nine of the studies reviewed. Social support has been shown to be important in ensuring better medication and treatment adherence, and reducing the risk of hospitalization [52–54].

## Advanced non-malignant diseases

Patients described as palliative or 'terminal' (defined as death being imminent or a life expectancy less than one year) were excluded from ten of the studies reviewed. This may be problematic with respect to advanced non-malignant conditions such as heart failure, for which accurate prediction of life-expectancy at the individual level is difficult [55]. Patients with advanced heart failure are at particularly high risk of rehospitalization, and their potential exclusion from a transitional care intervention based on an inaccurate estimate of life expectancy may not be justifiable. Evidence from an RCT of a disease management program for palliative care patients with both malignant and advanced non-malignant diseases suggests that even among such patients, programs focused on enhancing self-care and symptom management can reduce the risk of rehospitalization [55]. The Canadian Cardiovascular Society Heart Failure Management Guidelines (2008) [56] recognizes that patients with advanced heart failure are likely to benefit from transitional care programs.

## Study limitations

This review has several limitations. Transitional care is an evolving concept with many definitions, approaches and levels of involvement. Our results are therefore not applicable to transitional care of patients in other age groups or between settings other than hospital and community. Restricting this review to randomized controlled trials may have excluded other transitional care studies evaluated using different methods, but which may have yielded informative results.

## Conclusion

In summary, most of the transitional care interventions described in this review did not explicitly focus on older patients with risk factors for rehospitalization, such as cognitive impairment, dementia, depression, multiple comorbidities, polypharmacy, or nearing the end-of-life. Therefore, the results of published transitional care interventions are not readily generalizable to patients at highest risk of rehospitalization. Transitional care interventions should be developed and evaluated for such high-risk populations, as emphasized by Ferruci et al. [55] who advocated the creation of guidelines for trials to target higher-risk older adults, such as those with dementia, and cautioned that overly restrictive inclusion criteria due threaten the generalizability of trials that fail to adhere to such guidelines.

# Acknowledgements

This research was supported by an Emerging Team Grant from the Canadian Institutes of Health Research.

We are grateful to Jackie Stapleton for her assistance with the search strategy.

## Author contributions

All authors meet the criteria for authorship stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals.

**Emily Piraino:** Conception and design, acquisition of data, interpretation of data, primary author of article content, approved final version submitted.

**Dr. George Heckman:** Conception and design, interpretation of data, revising article, and final approval of version submitted.

**Christine Glenny:** Conception and design, data analysis, drafting article, final approval of version submitted.

**Dr. Paul Stolee:** Conception and design, data interpretation, revising article, final approval of version submitted.

No sponsor was included.

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# Appendix A Search string used in medline

## Search 1:

"Case management" [MESH] OR "case management" [TIAB] OR "case manager" [TIAB] OR "care management" [TIAB] OR "care manager" [TIAB] OR "patient discharge" [MESH] OR "transition" OR "transitions" OR "transitioning" OR "patient transfer" OR "hand off" OR "hand-off" OR "transitional" OR "follow-up care" OR "follow-up service" OR "discharge planning" OR "post-discharge support" OR "hospital discharge".

## Search 2:

Hospital [TIAB] OR hospital [MESH] OR "medical centre" OR "clinic" OR "health service" OR "hospitalization" OR "acute care" OR "postacute".

## Search 3:

Search 1 + Search 2 AND "randomized".

**Appendix B.** Summary of study subjects and transitional care interventions

| Article | Inclusion criteria/exclusion criteria | Baseline characteristics (Intervention group) | Transitional care intervention |
|---|---|---|---|
| Arbaje et al., 2009 [33]<br><br>**USA** | **General target: older adults**<br>**Age 70+**<br>English-speaking or have English-speaking caregiver available<br>If patient was unable to make own decisions, caregiver could consent | n=366<br>Mean age: 79.7<br>Gender: 60% Female<br>Race: 57% Caucasian<br>Living status: NR<br>Comorbidies NR<br>Medications: NR<br>Cognitive status: NR<br>Depression: NR | **The Geriatric Floating Interdisciplinary Team (Geri-FITT)**<br>**Aim:** To improve acute and post-acute care by combining aspects of geriatric evaluation and transitional care interventions into a comprehensive acute and post-acute co-management intervention<br>Aim to improve adherence, patient satisfaction, health status, medical errors, adverse drug reactions and readmission rates<br>**Intervention**: Includes geriatric nurse practitioner and geriatrician<br>*Pre-discharge:* Patients are evaluated by geriatric nurse practitioner<br>Patients' geriatric syndromes are managed<br>Care plan is created with patient's geriatrician<br>Patients and caregiver are prepared for transition through being taught self-management, having a transition plan developed<br>Intervention team also teach medical-nursing teams in use of geriatric care best practices<br>*Post-discharge:* Patients' and geriatric nurse practitioner are contacted through faxed letter<br>Phone call is made to patient or caregiver |
| Atienza et al., 2004 [16]<br><br>Ojeda et al., 2005 [56]<br><br>**Spain** | **General target: CHF** [#] **patients**<br>Primary diagnosis of CHF<br>Excluded if life expectancy under three months<br>Excluded dementia or psychiatric illness | n=164<br>Mean age: 69<br>Gender: 38% Female<br>Race: NR<br>Living status: 12% live alone<br>Comorbidies: reported cardio related by condition<br>35% diabetes<br>54% hypertension<br>33% ischemic heart disease<br>24% valvular heart disease<br>Medications: listed as percent by medication<br>Cognitive status: NA<br>Depression: NA | **Hospital discharge and outpatient HF**[*] **program**<br>**Aim:** To provide comprehensive discharge planning, easy availability for consultations and close follow-up<br>Aim to prolong time to first event and reduce hospital readmissions<br>**Intervention**:<br>*Phase 1, pre-discharge:* Patients and family receive formal education addressing self-management<br>Patients are provided a brochure and nurse interview<br>*Phase 2, post-discharge:* Patients are visited by primary care provider within two weeks of discharge<br>*Phase 3, post-discharge:* Patients make follow-up visits at HF clinic<br>Each phase includes telemonitoring (24 hour mobile phone contact number) and available consultation with HF team |
| Coleman et al., 2006 [6]<br><br>**USA** | **General target: older adult patients**<br>Age 65+<br>Admitted for a non-psychiatric condition<br>Community-dwelling<br>Must reside within a predefined geographic radius<br>English-speaking<br>No plans to enter hospice<br>Must have at least one of eleven diagnoses: stroke, CHF, coronary artery disease, | n=379<br>Mean age: 76.0 (7.1)<br>Gender: 48.3% Female<br>Race: 88.1% Caucasian<br>Living status: 31.0% live alone<br>Comorbidities from discharge diagnoses:<br>Stroke=2.4%<br>CHF=16.5%<br>Coronary artery disease=14.1%<br>Cardiac arrhythmia=12.8%<br>Chronic obstructive pulmonary disease=16.8%<br>Diabetes mellitus=2.7% | **The care transitions intervention**<br>**Aim:** To encourage older patients and their caregivers to become actively involved during care transitions<br>**Intervention**:<br>*Pre-discharge:* Patients meet with transition coach<br>*Post-discharge:* Patients receive home visit within 48–72 hours after hospital discharge<br>Follow-up phone calls<br>Patients are taught medication self-management<br>Patients are taught to recognize symptoms of worsening of condition<br>Patients have a primary care provider follow-up arranged<br>Patients are provided a patient-centered personal health record |

*Appendix B.* (continued)

| Article | Inclusion criteria/exclusion criteria | Baseline characteristics (Intervention group) | Transitional care intervention |
|---|---|---|---|
| | cardiac arrhythmias, chronic obstructive pulmonary disease, diabetes mellitus, spinal stenosis, hip fracture, peripheral vascular disease, deep venous thrombosis, and pulmonary embolism | Hip fracture=4.0%<br>Dehydration=4.5%<br>Pneumonia=8.0%<br>Chronic disease score, mean (SD)=6.8 (3.5)<br>Medications: NR<br>Cognitive status: NR<br>Depression: NR | |
| Parry et al., 2009 [41]<br><br>**USA** | **General target: older adult patients**<br>See Coleman, 2006 | n=49<br>Mean age=80.5<br>Gender: 75.5% Female<br>Race: 87.8% Caucasian<br>Living status: 55.1% live alone, 71.4% unmarried<br>Comorbidities:<br>Stroke: 2.2%<br>CHF: 20.0%<br>Coronary artery disease: 6.7%<br>Cardiac arrhythmia: 13.3%<br>Chronic obstructive pulmonary disease: 15.6%<br>Diabetes: 0.0%<br>Hip fracture: 11.1%<br>Dehydration: 15.6%<br>Pneumonia: 15.6%<br>Medications: NR<br>Cognitive status: NR<br>Depression: NR | **The care transitions intervention**<br>See Coleman, 2006 |
| Harrison et al., 2002 [17]<br><br>**Canada** | **General target: CHF patients**<br>Must be diagnosed with CHF<br>Must be English or French speaking<br>Excluded if cognitively impaired | n=92<br>Mean age: 75.5<br>Gender: 47% Female<br>Race: NR<br>Living status: 50% live alone<br>Comorbidies: mean 3.95 (1.94)<br>Medications: mean 6.23 (3.08)<br>Cognitive status: NR<br>Depression: NR | **Transitional care**<br>**Aim:** To improve QOL‡‡ and health service utilization for individuals admitted to hospital with HF through the use of usual providers, and a reorganization of discharge planning and transition care with improved inter-sector linkages between nurses<br>**Intervention**: Education-counseling protocol—Partners in care for CHF<br>*Pre-discharge:* Patient are provided with patient workbook, education map, nursing transfer letter to health care provider<br>*Post-discharge*: Phone call made to patient |
| Huang and Liang, 2005 [18]<br><br>**Taiwan** | **General target: hip fracture patients**<br>Age 65+<br>Must have hip fracture due to fall<br>Excluded patient with cognitive impairment<br>Excluded patient too ill due to comorbidities | n=63<br>Mean age: 75.9 (7.6)<br>Gender: 63.5% Female<br>Race: NR<br>Living status: 96.8% live with family; live alone NR<br>Comorbidies: reported number<br>0=28.6%<br>1=49.2% | **Discharge planning intervention**<br>**Aim:** To decrease LOS§§, rate of readmission to hospital, rate or repeat falls, mortality and improve ADLs¶¶ for older adults who had a hip fracture<br>**Intervention**: Goal was to design a discharge plan suitable to each patient, this intervention continued for three months after discharge<br>*Pre-discharge:* Patients receive a brochure with information on conditions and self-care, second brochure on fall prevention and safety<br>*Post-discharge:* Nurse provided education and 'confirmation of learning' Nurses manage resources in the community with home visits |

*Appendix B.* (continued)

| Article | Inclusion criteria/exclusion criteria | Baseline characteristics (Intervention group) | Transitional care intervention |
|---|---|---|---|
| | Excluded those unable to communicate<br>Excluded if required to stay in intensive care unit | 2=15.9%<br>≥3=6.3%<br>Medications: NR<br>Cognitive status: NR<br>Depression: NR | |
| Jaarsma et al., 1999 [37]<br><br>**Netherlands** | **General target: patients with HF**<br>Age 50+<br>Diagnosed with HF based on Boston scoring system (ranges from 0 to 12 where 8 or higher indicates HF)<br>New York Heart Association functional class III and IV (poor to severe HF)<br>Diagnosis of HF at least three months before<br>Literate in Dutch<br>Excluded if suffering from a coexisting, severe, chronic, debilitating disease<br>Excluded if next care setting is nursing home<br>Excluded if there is a psychiatric diagnosis | n=84<br>Mean age=73.0 (9)<br>Gender: 44% Female<br>Race: NR<br>Living status: 8% independent living, 46% single or widowed, 54% married<br>Comorbidities:<br>Diabetes mellitus=32%<br>Hypertension=26%<br>Lung disease=21%<br>Rheumatoid arthritis=7%<br>Medications: NR<br>Cognitive status: NR<br>Depression: NR | **Supportive education intervention**<br>**Aim:** To teach patients to properly manage their HF using a standard nursing care plan<br>Patients learn skills such as recognition of warning symptoms of worsening HF, sodium restriction, fluid balance and compliance<br>**Intervention:**<br>*Pre-discharge:* Patient's needs are assessed by study nurse<br>Patients and family are provided education and support from the study nurse<br>Patients are provided a card with warning symptoms<br>Study nurse discussed discharge<br>*Post-discharge:* Patients receive a call from study nurse to address any problems<br>Patients receive home visit for education purposes<br>Patients may call the study nurse<br>Patients are encouraged to contact cardiologist, general practitioner, or emergency heart center if they were experiencing difficulties |
| Koehler et al., 2009 [35]<br><br>**USA** | **General target: older adults, high-risk**<br>Age 70+<br>Must take five or more medications regularly, have three or more chronic comorbid conditions, and require assistance for one or more ADL<br>Must be English speaking<br>Excluded if admission was for surgical purposes<br>Excluded if life expectancy of less than six months<br>Excluded if living in any type of long-term care and returning there | n=20<br>Mean age: 77.2 (5.3)<br>Gender: 85% Female<br>Race: 70% Caucasian<br>Living status: 20% live alone, 75% live with family<br>Comorbidies: Mean Charlson Index of Comorbidity (where higher number indicates a more severe condition)=3.7 (1.1)<br>Medications: average inpatient medications: 12 (5)<br>Cognitive status: 23% dementia<br>Depression: 23% diagnosed | **Supplemental care bundle**<br>**Aim:** Target high-risk elderly inpatient to prevent hospital readmission and/or emergency department visitation<br>**Intervention**: Educational program that starts during hospitalization and continues one week following discharge<br>*Pre-discharge:* Care-coordinator provided instructions on specific conditions, how to follow effective self-care at home and what to do if problems occurred<br>Patients receive visits from pharmacists who educate on medications, accompanied by a personal health record<br>*Post-discharge:* Participants were telephoned to discuss new equipment and self-management |

*Appendix B.* (continued)

| Article | Inclusion criteria/exclusion criteria | Baseline characteristics (Intervention group) | Transitional care intervention |
|---|---|---|---|
| Kwok et al., 2008 [40]<br><br>**Hong Kong** | **General target: older adults with chronic HF include**<br>Age 60+<br>Diagnosed with CHF<br>Must reside within a predefined geographic radius<br>One or more hospital admission for CHF in the 12 months prior to the index admission<br>Excluded if there is difficulty communicating and no caregiver available<br>Exclude if residing in a nursing home<br>Exclude if diagnosed with terminal disease, life expectancy of less than six months | n=49<br>Mean age=79.5 (6.6)<br>Gender: 55% Female<br>Race: NR<br>Living status: 31% live alone<br>Comorbidies:<br>Left ventricular ejection fraction <40%: 18%<br>Ischemic heart disease: 48%<br>Myocardial infarction: 18%<br>Obstructive airway disease: 8%<br>Diabetes mellitus: 29%<br>Atrial fibrillation: 29%<br>Hypertension: 54%<br>Medications: NR, reported cardiac related discharge medications only<br>Cognitive status: NR<br>Depression: NR | **Community nurse-supported hospital discharge program**<br>**Aim:** To reduce the chance of readmission by improving functional status of older CHF patients<br>**Intervention**: Patients are visited by a community nurse prior to discharge and are visited at home within seven days of discharge<br>Subsequent home visits occurred at weekly intervals for the next four weeks, and monthly after that<br>*Pre-discharge:* Patients receive health counseling, such as drug compliance and dietary advice from community nurse<br>Patients are encouraged to call the community nurse if symptoms develop<br>*Post-discharge:* Home visits where vital signs and CHF symptoms are assessed<br>Medications are checked to ensure compliance<br>Community nurses can adjust medications and arrange urgent hospital outpatient appointments and clinical admission with permission from geriatrician or cardiologist |
| Laramee et al., 2003 [38]<br><br>**USA** | **General target: CHF patients**<br>**Include**<br>Diagnosed with CHF<br>Moderate-to-severe left ventricular dysfunction or radiographic evidence of pulmonary congestion<br>At-risk for early readmission due to the presence of one or more of the following criteria: history of CHF, documented knowledge deficits of treatment plan or disease process, potential or ongoing lack of adherence to treatment plan, previous CHF hospital admission, living alone, four or more hospitalizations in the past five years.<br>Exclude if next care setting is LTC (long-term care)<br>Exclude if planned cardiac surgery<br>Exclude if cognitive impairment present | n=141<br>Mean age=70.6 (11.4)<br>Gender: 42% Female<br>Race: NR<br>Living status: NR –51% married<br>Comorbidities:<br>Hypertension=71%<br>Diabetes mellitus=44%<br>Chronic obstructive pulmonary disease=26%<br>Peripheral vascular disease=19%<br>Smoker=19%<br>Hyperlipidemia=55%<br>Obesity=45%<br>Prior myocardial infarction=44%<br>Myocardial infarction this admission=23%<br>Ischemic origin for HF=68%<br>CHF as primary diagnosis=55%<br>Medications: NR<br>Cognitive status: NR<br>Depression: NR | **CHF case management**<br>**Aim:** To reduce readmissions in CHF patients<br>**Intervention:** Case manager assisted in the coordination of care while patient is in hospital and for 12 weeks following discharge<br>*Pre-discharge:* Patients receive early discharge planning, coordination of care, individualized and comprehensive patient and family education<br>Case manager coordinated services for the patient<br>Case managers aid communication between patient, caregiver and health care providers<br>The educational component of this intervention provides information on CHF disease processes, diet and fluid management, medication instructions, self-monitoring and symptom management, activity recommendations, cardiac risk factor modification, prognosis, and counseling<br>Patients receive educational materials.<br>*Post-discharge:* Telephone follow-up for 12 weeks<br>Patients are further encouraged to manage their medications properly |

*Appendix B.* (continued)

| Article | Inclusion criteria/exclusion criteria | Baseline characteristics (Intervention group) | Transitional care intervention |
|---|---|---|---|
| | Exclude if anticipated survival is fewer than three months<br>Exclude if patient will receive long-term hemodialysis | | |
| McDonald et al., 2002 [36]<br><br>**Ireland** | **General target: HF patients**<br>Age 18+<br>Diagnosed with HF<br>Excluded if patient had unstable angina or MI<br>Excluded life expectancy was less than three months<br>Excluded patients with cognitive impairment | n=51<br>Mean age=70.76 (76)<br>Gender: 37% Female<br>Race: NR<br>Living status: NR<br>Comorbidies: NR<br>Medications: NR, reported cardiac related discharge medications only<br>Cognitive status: NR<br>Depression: NR | **Multidisciplinary care**<br>**Aim:** Providing a multidisciplinary care program pre and post discharge with the goal of reducing hospital readmissions and mortality for patients with HF<br>**Intervention**:<br>*Pre-discharge:* Patients receive at least three consultations with nurse and dietitian<br>Intervention focuses on weight monitoring, disease and medication understanding, and salt restriction<br>*Post-discharge:* Patients receive a phone call from nurse<br>Patients attend a HF clinic for educational purposes |
| Naylor et al., 1999 [5]<br><br>**USA** | **General target: older adults**<br>Age 65+<br>Admitted from home<br>Diagnosed with one of: CHF, angina, myocardial infarction, respiratory tract infection, coronary artery bypass graft, cardiac valve replacement, major small and large bowel procedure, and orthopedic procedures of lower extremities<br>Patients also had to meet at least one of the following criteria: age 80 years or older; inadequate support system; Multiple active, chronic health problems; history of depression; moderate-to-severe functional impairment; multiple hospitalizations during prior 6 months; hospitalization in the past 30 days; fair or poor self-rating of health; or history of non-adherence to therapeutic regimen<br>Must be English-speaking<br>Alert and oriented when admitted<br>Must reside within a predefined geographic radius | n=177<br>Mean age=75.5 (6.3)<br>Gender: 46% Female<br>Race: 56% Caucasian<br>Living status: NR<br>29% report no social support<br>Comorbidities: average number of health conditions=5.3 (1.8)<br>Medications: average number of medications=5.3 (2.7)<br>Cognitive status: NR<br>Depression: NR | **Advanced practice nurse**<br>**Aim:** To improve patient outcomes and reduce service utilization and health care costs<br>**Intervention**: Advanced practice nurse manages patient's discharge planning as well as four weeks post-discharge follow-up<br>*Pre-discharge:* Patients are assessed by advanced practice nurse<br>APNs consult physicians and other HCPs to create discharge plan<br>*Post-discharge:* Patients and caregiver have health issues addressed through home visits and phone follow-up<br>Interventions focuses on medications, symptom management, diet, activity, sleep, medical follow-up, emotional status of patients and caregivers<br>Following intervention, discharge summaries are sent to patients, caregivers, physicians, and other health care providers |

*Appendix B.* (continued)

| Article | Inclusion criteria/exclusion criteria | Baseline characteristics (Intervention group) | Transitional care intervention |
|---|---|---|---|
| Naylor et al., 2004 [2]<br><br>**USA** | **General target: HF patients**<br>Age 65+<br>Admitted to study hospitals from home during study period<br>Diagnosed with HF<br>Must be English-speaking<br>Be alert and oriented<br>Must reside within a predefined geographic radius<br>Exclude end-stage renal disease | n=118<br>Mean age=76.4 (6.9)<br>Gender: 60% Female<br>Race: 66% Caucasian<br>Living status: NR<br>36% reported no social support<br>Comorbidities: Average comorbidities=6.04 (2.5)<br>CAD=53%<br>Atrial tachycardia=46%<br>Diabetes mellitus=38%<br>Pulmonary disease=35%<br>Medications: 7 (3.1)<br>Cognitive status: NR<br>Depression: NR | **Advanced practice nurse**<br>**Aim:** To target HF patients by managing health problems and risk factors common in elders during acute episodes of HF<br>**Intervention:** Advanced practice nurses are responsible for the patient's discharge planning as well as 3-months post-discharge<br>*Pre-discharge:* Patients are assessed by advanced practice nurse<br>Advanced practice nurses collaborate with physicians and other HCPs to form a discharge plan and ensure continuity of care<br>*Post-discharge:* Patients are assessed for any health status changes<br>Problems that may arise are identified<br>Advanced practice nurses target patients goals during intervention<br>Patients have all education sessions audiotaped and receive recordings following intervention<br>Recordings also provide information on patient's comorbid conditions<br>Advanced practice nurses share information with patients, caregivers, physicians, and other providers regarding patient goals, unresolved issues, and recommendations |
| Thompson et al., 2005 [19]<br><br>**UK** | **General target: patients with chronic HF**<br>Diagnosed with and hospitalized for CHF<br>Must be discharged to home<br>Exclude if terminal illness other than CHF | n=42<br>Mean age=73 (14)<br>Gender: 28% Female<br>Race: NR<br>Living status: 28% live alone<br>Comorbidities: Mean Charlson Index of Comorbidity Score=2.5 (1.4)<br>Prior acute myocardial infarction=47%<br>Chronic airways limitation=26%<br>Atrial fibrillation=28%<br>Non-insulin/Insulin dependent diabetes=14%<br>Medications: Lists CHF-related medications<br>Cognitive status: NR<br>Depression: NR | **Clinic and home-based intervention**<br>**Aim:** To improve event-free survival rates and reduce the rate of readmissions in CHF patients who have been hospitalized<br>**Intervention:**<br>*Pre-discharge:* Patients meet with study-nurse<br>*Post-discharge:* Patients receive a home visit within ten days of hospital discharge<br>Patients receive information on their condition, medications, and at-home management<br>Patients may call nurses with any questions<br>Patients receive education regarding symptom recognition, symptom management and lifestyle issues<br>Patients receive clinical examination and review of history since discharge<br>Families may attend home-visits<br>Patients may attend monthly nurse-led outpatient HF clinics<br>Patients receive clinical examination at clinics<br>Patients receive an educational package |
| Tsuyuki et al., 2004 [39]<br><br>**Canada** | **General target: HF patients**<br>Age 18+<br>Primary diagnosis and hospitalized for HF<br>Exclude if known secondary causes of HF<br>Exclude if terminal illness with a life expectancy less than six months<br>Exclude if cognitively impaired | **Stage 2 (intervention)**<br>n=150<br>Mean age=71 (12)<br>Gender: 42% Female<br>Race: NR<br>Living status: NR<br>Comorbidities: NR—only heart conditions reported in stage 1<br>Medications: only heart-condition | **REACT (Review of Education on ACE inhibitors in CHF Treatment)**<br>**Aim:** Improve HF patient compliance to ACE inhibitors through in-hospital intervention and to improve medication adherence, clinical outcomes, and reduce cost of care in outpatients<br>**Intervention:** This intervention consisted of two separate stages. In stage 1, patients have their medication regimes reevaluated for dose appropriateness<br>Stage 2 provides patients with in-hospital education sessions and materials |

*Appendix B.* (continued)

| Article | Inclusion criteria/exclusion criteria | Baseline characteristics (Intervention group) | Transitional care intervention |
|---|---|---|---|
| | Exclude if unable to communicate due to language barriers<br>Exclude if already attending a specialized HF clinic for medical management<br>**Stage 2**<br>Must reside within a predefined geographic radius<br>Discharged to SNF | medications reported<br>Cognitive status: NR<br>Depression: NR | *Pre-discharge:* In-hospital patient education and material provision<br>*Post-discharge:* Follow-up with research coordinator to improve adherence to self-management strategies and to reinforce education received in pre-discharge phase<br>Emphasis on salt and fluid restriction, daily weighing, exercise alternating with rest periods, proper medication use, knowing when to call their physician<br>During follow-up, patients receive educational materials |
| Zhao and Wong, 2009 [34]<br><br>**Hong Kong** | **General target: coronary heart disease patients**<br>**Include**<br>Age 60+<br>Confirmed diagnosis of angina or myocardial infarction<br>Must be Mandarin-speaking and able to communicate<br>Must reside within a predefined geographic radius<br>Admitted from home and would be discharged to home<br>Excluded patients with psychosis, dementia, dying | n=100<br>Mean age=71.6<br>Gender: 49% Female<br>Race: NR<br>Living status: 57% living with spouse, 28% living with child, 8% living with grandchild, 8% living alone<br>Comorbidities:<br>Barthel index: 91.95 (18.68) (scale ranges from 0–100, higher means better ADL)<br>No report specifically on comorbidities, talks about other health symptoms such as hearing, vision, sleeping patterns<br>Medications: NR<br>Cognitive status: NR<br>Depression: NR | **Transitional care model for CHD patients**<br>**Aim:** To provide coordinated care to improve participants' self-management abilities. This is done by improving post-discharge understanding and adherence of diet, medications, exercise and health-related lifestyle<br>Aims to reduce health care utilization and improve satisfaction with care in coronary heart disease patients<br>**Intervention:** Intervention focuses on being comprehensive, providing care coordination and continuity, and being collaborative. Nurses assess patients' condition and manage transition from hospital to community<br>Nurses communicate between patient and hospital<br>Patient is involved in health-related goal setting.<br>*Pre-discharge:* Patients are assessed for understanding and adherence behaviors with regard to diet, medications, exercise and health-related lifestyle<br>*Post-discharge:* Community nurse follows-up with patient for four weeks beginning on the second day<br>Follow-up phone calls also take place |

*Not reported, †Three-item care transitions measure, ‡Intervention group, §Control Group, ¶Short-term and long-term follow-up of same study, #Congestive heart failure, **Heart failure, ‡‡Quality of Life, §§Length of Stay, ¶¶Activities of daily living.

**Appendix C.** Summary of intervention characteristics (Y=yes; N=no)

| Article | Components* | Delivery | | | | |
|---|---|---|---|---|---|---|
| | Single vs. multiple modalities | Doctor | Nurse | Other allied health professional | Non-professional care provider | Informal care provider |
| Arbaje et al., 2010 [33] | Multi | Y | Y | N | N | Y |
| Atienza et al., 2004 [16] | Multi | Y | Y | Y | N | Y |
| Coleman et al., 2006 [6] | Multi | N | Y | N | Y | N |
| Parry et al., 2009 [41] | Multi | N | Y | N | Y | N |
| Harrison et al., 2002 [17] | Multi | N | Y | Y | Y | N |
| Huang and Liang 2005 [18] | Multi | N | Y | N | N | N |
| Jaarsma et al., 1999 [37] | Multi | N | Y | N | N | N |
| Koehler et al., 2009 [35] | Multi | N | Y | Y | N | N |
| Kwok et al., 2008 [40] | Single | N | Y | N | N | N |
| Laramee et al., 2003 [38] | Multi | N | Y | N | N | N |
| McDonald et al., 2002 [36] | Multi | N | Y | Y | N | Y |
| Naylor et al., 1999 [5] | Multi | N | Y | N | N | Y |
| Naylor et al., 2004 [2] | Multi | N | Y | N | N | Y |
| Thompson et al., 2005 [19] | Multi | N | Y | N | N | N |
| Tsuyuki et al., 2004 [39] | Multi | N | Y | Y | N | N |
| Zhao and Wong, 2009 [34] | Multi | N | Y | N | N | N |

*Modalities of an intervention are activities and materials that comprise the strategy. Interventions can either have a single modality (such as multiple telephone calls) or multiple modalities (one telephone call and an education package).
†Successful outcomes were defined as interventions that achieved a desirable significant difference between the intervention and control group in at least one of the primary outcome measured.