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The impact of transitional care programs on health services utilization in community-dwelling older adults: A systematic review

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Executive summary

Background

There is growing evidence that transitional care programs can help address important challenges facing health care systems and our increasing older adult population in many countries by reducing unnecessary health service utilization. There is a need for a current systematic review of the research evaluating the impact of transitional care programs on hospital and other health service usage.

Objectives

The objective was to identify and synthesize the best available evidence on the impact of transitional care programs on various forms of health services utilization in community-dwelling older adults.

Inclusion criteria

Types of participants

Participants were community-dwelling adults age 60 and older with at least one medical diagnosis.

Types of intervention(s)/phenomena of interest

This review considered studies that evaluated the outcomes of transitional care programs on health system utilization of older adults.

Types of outcomes

The outcomes for this review were hospital usage including admissions and readmissions, emergency department usage, primary care/physician usage, nursing home usage, and home health care usage.

Types of studies

The current review considered experimental and epidemiological study designs including randomized controlled trials, non-randomized controlled trials, quasi-experimental studies, before and after studies, prospective and retrospective cohort studies, and case control studies.

Search strategy

A three-step search was utilized to find published and unpublished studies conducted in any country, but reported in English. Six electronic databases were searched from inception of the database to May, 2016. A search for unpublished studies was also conducted.

Methodological quality

Methodological quality was assessed independently by two reviewers, using the Joanna Briggs Institute critical appraisal checklist for systematic reviews and research synthesis.

Data extraction

Quantitative data were extracted from included studies independently by the two reviewers using the standardized Joanna Briggs Institute data extraction tools.

Data synthesis

Due to the methodological heterogeneity of the included studies, a comprehensive meta-analysis for all outcomes was not possible. Meta-analysis was conducted for rehospitalization at 30, 90, and 180 days. A narrative summary of other quantitative findings was conducted.

Results

Twenty-three studies met the inclusion criteria and were included in the review. Nineteen of the studies were randomized controlled trials and 4 were case control studies, together involving 20,997 participants with a mean age of 76. Meta-analysis found that transitional care significantly reduced hospital readmission rates at 30 days (odds ratio [OR] 0.75, 95% confidence intervals [CIs] 0.62-0.91, $p<0.01$), 90 days (OR 0.77, 95% CIs 0.59-1.02, $p=0.04$), and 180 days (OR 0.67, 95% CIs 0.46-0.99, $p<0.01$). Narrative synthesis indicated little impact of transitional care on emergency department and nursing home usage, increased use of primary care/physician usage, and decreased home health care usage.

Conclusions

Based on a review of 23 studies conducted in the USA, Hong Kong, Canada, Germany, the Netherlands, Sweden, and Switzerland, we identified four major conclusions First, transitional care reduces rehospitalization rates over time, with the largest effects seen at 30 days. Second, transitional care may increase the utilization of primary care services and thus have a favourable impact on preventative care. Third, transitional care may reduce home health usage. Fourth, transitional care interventions of one month or less appear to be as effective as longer interventions in reducing hospital usage.

Keywords Aged; community-dwelling; health service usage; transitional care

Introduction

Background

Transitional care is a set of actions designed to ensure the coordination and continuity of health care as people transfer between different locations or different levels of care within the same location.[1] As

people and their unpaid caregivers move across types of health care, transitional care supports them through this process.[2] Health care professionals who provide transitional care are called health navigators. Health navigators collaborate with colleagues across sites of care and endeavour to ensure that transitions are safe and effective.[3] They provide many services, including: care planning, home visits, patient education, and assistance with medication management, fostering coordination and continuity across health settings, and early identification and response to health changes.[2,4]

In this systematic review, or focus in on transitional care that supports older adults and their caregivers. Health services used by older adults and their caregivers involve an array of services, including home and community-based services, physician and hospital-based services, and residential housing and care services. Health services are often delivered in 'silos' independent of each other. As such, older adults and their caregivers are required to navigate these services to sustain their health, yet, they experience inherent challenges in doing so which are detrimental to themselves and the health care system.[2] Previous research has identified a number of health and safety issues that arise during these transitions in care including: poor communication; inappropriate placement in long-term care facilities; delays in care, unnecessary and potentially unsafe care; mental health issues; transportation issues; and additional burden on unpaid caregivers.[5-10]

Some health care systems, such as in Canada, are primarily designed to address acute and episodic health issues, and a transformational shift is needed to better meet the chronic and continuing care needs of older adults to ensure better health outcomes.[11] In many instances, older adults with complex health conditions who have more than one medical diagnosis do not receive the services they need.[12] An increased focus is needed on person-centred care, the integration and continuity of care[13] and meeting both the medical and non-medical needs of older adults and caregivers.[4] In addition, access to a health professional with a coordination function across health care settings has shown to be advantageous, such as with navigation programs.[12] These programs involve older adults with a specific health issue receiving services from a health care professional over a brief period of time.

Research shows some indication that transitional care programs have positive outcomes for older adults, their caregivers and the health care system. An initial review of the research in the JBI Library, the Cochrane Library and CINAHL indicates that transitional care programs result in cost savings to health care systems. When older adults do not access appropriate services in a timely manner, this can lead to an increased burden of care for unpaid caregivers and increased health care costs.[14,15] One systematic review published in 2012 identified 9 randomized controlled trials focused on navigational support for chronically ill older adults through health care transitions.[4] This systematic review excluded all other types of quantitative evidence, other than systematic reviews, and it did not specifically focus on studies with outcomes related to health services usage. One conclusion of this review was that additional research is needed to assess the effectiveness and cost of health navigator programs. In addition, a narrative review of the impact of transitional care on older adult rehospitalizations in the United States of America (USA) found that transitional care programs reduced rehospitalizations[16] As

both of these reviews included studies published until 2011, there is a need to review recent research on transitional care programs [11] and outcomes related to health services utilization beyond only hospital admissions and emergency department (ED) use.[17] There is some evidence that these programs can reduce or delay admission to nursing homes. Findings from the Canadian National Population Health Survey suggest that access to various publicly funded home and community-based services, such as transitional care, could reduce the probability of institutionalization, such as nursing home admissions.[18] Also, early discharge from acute care facilities without appropriate transitional care can lead to increased and unnecessary transitions into a residential care facility.[19]

Since the creation of the Affordable Care Act in the USA in 2010, several transitional care programs have been established to support chronically ill adults with various health transition needs, and these programs primarily focus on reducing hospital readmissions[20] After accounting for the cost of a transitional care intervention, one program saved almost $300,000 per year through fewer hospital readmissions[2] Hospitals make up the largest component of health care spending in Canada at 29.6% of total health care expenditures, and other institutions, including nursing homes and residential care facilities, account for 10.3% of total health expenditures.[21] Public funding covers approximately 70% of total health care costs in Canada and those aged 65 and older account for 44% of provincial health care expenditures.[13] As such, in this review, we focus on research outcomes related to the impact of transitional care programs on various forms of health service utilization for older adults to better understand their impact on these costs.

There is growing evidence that transitional care programs are essential to address important challenges facing health care systems and our growing older adult population by reducing unnecessary hospital admissions, readmissions and premature nursing home placements.[2,4,19] These types of health care services are used heavily by older adults, and they are expensive to deliver. Shortages of hospital and nursing home beds in Canada already exist, and there is little evidence of how health care systems are going to manage exponential increases in health service demand from an expanding aging population. Trends toward early discharge from hospitals, and subsequently more recovery at home, requires greater planning before discharge and increased follow-up services in the community. However, home and community supports have not kept pace with this demand.[22] A systematic review on the impact of transitional care programs on health care utilization is essential to contribute to the implementation of evidence-based transitional care programs.

Objective

The objective was to identify and synthesize the best available evidence on the impact of transitional care programs on various forms of health services utilization in community-dwelling older adults.

Inclusion criteria

Types of participants

This review considered studies that included community-dwelling adults age 60 and older with at least 1 medical diagnosis.

Types of intervention/phenomena of interest

This review considered quantitative studies that evaluate the outcomes of transitional care programs on health system utilization of older adults. The intervention is the utilization of a transitional care program. The comparator is standard care, or no utilization of a transitional care program.

Types of studies

This review considered both experimental and epidemiological study designs including randomized controlled trials, non-randomized controlled trials, quasi-experimental studies, before and after studies, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies as appropriate for inclusion. This review also considered descriptive epidemiological study designs including case series, individual case reports and descriptive cross sectional studies for inclusion.

Types of outcomes

This review considered studies that included the following primary outcomes: hospital admissions, hospital readmissions, ED visits, and nursing home admissions. Secondary outcomes included: primary care visits, home care use, rehabilitation services use, and walk-in clinic visits. For each primary and secondary outcome, various measures of health service usage were used such as the number of visits and/or the number of days of use.

Search strategy

The search strategy aimed to find both published and unpublished studies. A three-step search strategy was utilised in this review. An initial limited search of MEDLINE and CINAHL was undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe articles. A second search using all identified keywords and index terms was undertaken across all included databases. Thirdly, the reference list of all identified reports and articles was searched for additional studies. Studies published in English were considered for inclusion in this review. Date limits were not applied.

The databases searched included: CINAHL, ISI Web of Science, Medline, EMBASE, PsycINFO and Scopus. The search for unpublished studies included: Grey Literature Report in Public Health, Canadian Electronic Library (government reports), Proquest (dissertation and thesis), DIVA (dissertations and other publications and other publications from Nordic Universities), targeted Google search for organizations (home care organizations, gerontological associations, and SIGLE (System for information on Grey Literature in Europe). The full search strategy for Medline, CINAHL, and Embase is provided in Appendix I.

Assessment of methodological quality

Papers selected for retrieval were assessed by two independent reviewers for methodological validity prior to inclusion in the review, using the standardized critical appraisal checklist for systematic reviews and research synthesis from the Joanna Briggs Institute (JBI) System for Unified Management, Assessment and Review Instrument and the JBI Reviewers' Manual 2014.[23] Any disagreements that arose between the reviewers were resolved through discussion, or with a third reviewer.

Data extraction

Data were extracted from papers included in the review using the standardized JBI data extraction form for systematic reviews.[23] The data extracted included specific details about the interventions, populations, study methods and outcomes of significance to the review question and specific objectives.

Data synthesis

Data were, where possible, pooled using statistical meta-analysis. All results were subjected to double data entry. Effect sizes expressed as odds ratio [OR] and their 95% confidence intervals were calculated for analysis. Heterogeneity was assessed statistically using the standard Chi-square and also explored using subgroup analyses based on the different quantitative study designs included in this review. In the presence of significant heterogeneity of interventions, random effects meta-analysis was used. Where statistical pooling was not possible, the findings were presented in narrative form including tables and figures to aid in data presentation where appropriate.

Results

Study selection

The study selection flow chart is in Figure 1. A total of 12,406 records were identified through implementing the search strategy, and an additional 19 records were identified through a search of the reference lists of included studies. After duplicates were removed, a total of 6,315 records remained that underwent title and abstract screening. A total 197 records remained after that process was completed, and these records underwent full-text screening. After full-text screening was completed, 69 studies were retrieved for methodological quality assessment using the standardized critical appraisal checklists for systematic reviews.[23] The 46 excluded studies and reasons for exclusion are listed in Appendix II. A total of 23 studies published between 1999 and 2016 met all inclusion criteria for this review and quality appraisal, and 12 were published between 2014 and 2016. The characteristics of the 23 included studies are found in Appendix III, and the findings and conclusions of included studies can be found in Appendix IV.

Description of studies

The 23 studies within this review included 19 randomized controlled trials and 4 comparable cohort/case control studies (see Appendix III for characteristics of included studies). Of the randomized controlled

1 trials, 18 studies had one intervention group (IG) and a control group (CG) receiving usual care, and 1

2 study had two IG groups and a CG.[24] All of the 4 comparable cohort/case control studies had an IG and

3 a CG or comparison group.

4 While 60% of the studies took place in the USA (n=14), 3 studies took place in Hong Kong,[24-26] 2 in

5 Canada,[27,28] and one in each of Germany,[29] the Netherlands,[30] Sweden,[31] and Switzerland.[32]

6 Most (n=20, 87%) of the 23 included studies involved recruiting patients who were currently or recently

7 hospitalized or discharged from an ED and the intervention continued after patients were discharged to

8 their homes in the community. Three studies involved either recruiting patients from a primary care

9 practice[33,34] or recruiting patients through invitations sent by health and social service organizations.[32]

10 Included studies involved a total of 20,997 participants and 56.7% were women. The minimum age was

11 60 for those studies that included a minimum age requirement, although the mean age of all participants

12 was 76.3 (range=65.1-85.0).

13 Heath status criteria for participation varied between the studies, but all included some criteria that put

14 participants at risk for increased health system usage, such as recent hospitalizations, needing

15 assistance with activities of daily living (ADLs) or instrumental activities of daily living (IADLs), a

16 minimum number of medications, several chronic diseases, or a lack of psychosocial support. Some

17 studies used a screening tool such as the Seniors at Risk-Hospitalized Patients Tool[30] or included

18 participants with at least one specific condition such as myocardial infarction, congestive heart failure,

19 stroke, chronic obstructive pulmonary disease, or pneumonia.[25,26,29,35-37]

20 Based on the evidence in the included studies, the outcome measures were clustered into the following

21 5 categories: 1) hospital usage, 2) ED usage; 3) primary care/physician usage; 4) nursing home usage;

22 and 5) home health care usage. There was wide variation in the ways in which health system utilization

23 was measured across the 23 studies within these 5 categories, such as: number of visits within various

24 time periods (e.g. 1 month, 2 months, 3 months, 6 months, 24 weeks, 1 year), number of total

25 admissions, mean or median usage, and increased use. In some instances, the cost of health care was

26 included as an outcome measure.

27 ***Intervention characteristics***

28 Table 2 contains a comparison of the interventions utilized in the included studies, including who

29 provided transitional care, the type of contact provided, the amount of support provided, and the length

30 of the intervention.

31 Transitional care services generally began with a baseline assessment to identify participant needs,

32 and care was largely tailored to meet individual needs. Common supports provided included:

33 coordinating and facilitating care across settings and care providers; support with accessing health and

34 community services; providing information and education; health monitoring; health management and

35 intervention; physical and environmental assessments; medication support; help with navigating the

1 health system; supporting empowerment, autonomy, and self-management to help participants better

2 manage their own health; encouraging the patient and caregiver to assert a more active role during

3 care transitions; and support for unpaid caregivers. In four studies, the intervention included a patient-

4 centred record owned and maintained by the participant.[2,37-39] Two interventions involved the utilization

5 of an electronic health record as part of the intervention.[30,40] One intervention involved participants

6 developing and implementing an action plan.[32]

7 In relation to transitional care service delivery, nurses were most commonly identified as the providers.

8 In total, 16 (70%) of the studies involved nurses, and most commonly were identified as nurses or

9 registered nurses (n=11, 48%). In one of these studies, nursing students worked with registered

10 nurses.[26] In 4 studies, service providers were advance practice nurses,[2,32,36,41] and 1 study involved

11 nurse practitioners as transitional care providers.[38] Other transitional care providers were identified as

12 social workers in 2 studies[42,43] or consisting of an interdisciplinary or inter-professional team in 3

13 studies.[27,31,40] In two studies, the qualifications of the transitional care providers were not specified but

14 only identified as a transition coach,[44] community-health worker, or patient navigator.[45]

15 For the studies that recruited hospitalized patients, transitional care support generally began in the

16 hospital setting, such as providing comprehensive face-to-face geriatric assessment process. There

17 was wide variation across included studies in the way that transitional care was provided. In Table 2,

18 we include a summary of telephone and face-to-face support provided after discharge from hospital.

19 Nineteen (82.6%) of the interventions involved a combination of both telephone and face-to-face

20 support. Three studies included transitional care provided exclusively by telephone.[34,37,42] In a few

21 studies, participants were provided with a telephone number and could call transitional support

22 providers at their convenience.[33,41] One study provided transitional care exclusively through face-to-

23 face interactions.[30]

24 There were also wide variations across studies in the amount and length of transitional care support

25 provided. All but two studies included the number of contacts made, either by phone or face-to-face.[31,40]

26 For the 21 studies that included the number of contacts by transitional care service providers, they

27 ranged from 3 to 20 with a mean of 7.5 contacts across the studies. The length of time the transitional

28 care interventions were provided ranged from 5.8 days[42] to 2-3 years[31] with a mean of 5.5 months

29 across all studies.

30 ***Methodological quality***

31 Methodological quality was assessed using the 10-item JBI standardized critical appraisal tool for

32 randomized controlled trials (Table 3) and the 9-item JBI standardized critical appraisal tool for

33 comparable cohort/case control studies (Table 4).[23]

34 For the randomized controlled trials, a total of 19 studies met 7 criteria that the team decided prior to

35 the quality assessment process were necessary for inclusion (questions 1, 4, 6, 7, 8, 9, and 10).

36 Questions 2, 3, and 5 were deemed important but not essential for inclusion in this study. All of the

included studies were considered to have met the criteria for randomization (question 1), comparable CG and IG at baseline (question 6), the identical treatment of the groups other than the intervention (question 7), consistent measurement of outcomes (question 8), outcomes were measured in a reliable way (question 9), and appropriate statistical analysis used (question 10). All but one study (18/19) met the criteria for a description of outcomes among participants who withdrew (question 4). Prior to conducting the quality appraisal process, the team identified three items of least importance in assessing the quality of the studies (questions 2, 3, and 5). In this study involving transitional care support from health care professionals versus usual care, it was not possible for participants to be blinded to their allocation to either the IG or the CG (question 2). Thus, while no randomized controlled studies were able to meet this criterion, it was deemed not applicable. Most (14/19) of the studies indicated blinded allocation to treatment groups from the allocator (question 3). As assignment to treatment groups was truly random, those studies that did not ensure blinded allocators were included in this systematic review. Many (11/19) studies assured that those assessing outcomes were blind to the treatment allocation (question 5). As all studies included reliable ways of measuring outcomes (question 9), such as accessing health system usage data, we were less concerned with assessors being blind to treatment allocation.

For comparable cohort/case control studies, methodological quality was assessed using the 9-item JBI Critical Appraisal Checklist for comparable cohort/case control studies (Table 4). Prior to completing the quality assessment process, the team deemed that these studies needed to meet all 9 criteria. A total of 4 comparable cohort/case control studies met all of the quality assessment criteria.

Findings of the review

Due to methodological variations across the included studies, and the wide range in in how outcomes were measured, a comprehensive meta-analysis for all studies was not possible. A narrative approach was deemed appropriate in some instances. Findings related to the five health system usage outcomes examined in this study are presented below. This is followed by an analysis of the included studies by subgroup based on the length of the intervention. In some instances, specific P values were not reported in the studies and we refer to these results as either significant (SIG) or not significant (NS) findings.

Hospital usage

As indicated above, hospital usage was reported across the included studies in various ways, including readmission rates over time (e.g. 30 days, 90 day, and 180 days) and overall admissions from the time that transitional care was initiated.

One of the most commonly reported measures was 30 day readmission rates. For the 10 studies reporting the number of participants with 30 day hospital readmissions, the chi-square of 18.58, P=0.03 and I^2 of 52% indicated statistically significant heterogeneity and allowed testing for overall effect (Figure 2). The OR across studies was 0.75 (95% CI = 0.62-0.91) suggesting that transitional care did decrease 30 day hospital readmissions. Odds ratios for two studies for 30 day hospital readmission

1 rates were greater than 1.[35,42] In the Linden *et al.*[35] study, the participants were diagnosed with
2 congestive heart failure or chronic obstructive pulmonary disease and the mean age of the sample was
3 relatively young (66 for the IG and 68 for the CG). In the Altfeld *et al.*[42] study, the intervention was quite
4 brief with a mean duration of just 5.8 days.

5 For the 6 studies reporting events for 90 day hospital readmissions, the chi-square of 15.06, P<0.01
6 and I^2 of 67% indicated statistically significant heterogeneity and allowed testing for overall effect
7 (Figure 3). The OR across studies was 0.77 (95% CI = 0.59-1.02) suggesting that transitional care did
8 decrease 90 day hospital readmission rates. The odds ratio for the Linden *et al.*[35] study for 90 day
9 hospital readmission rates was greater than 1, and the odds ratio for the Dalla *et al.*[27] study was 0.99.
10 In both of these studies, the length of the interventions were relatively brief following hospital
11 discharge.[27,35]

12 For the 6 studies reporting events for 180 day hospital readmissions, the chi-square of 35.57, P<0.01
13 and I^2 of 86% indicated statistically significant heterogeneity and allowed testing for overall effect
14 (Figure 4). The OR across studies was 0.67 (95% CI = 0.46-0.99) suggesting that transitional care did
15 decrease 180 day hospital readmission rates. One study had an odds ratio of 1.23[30] and one study had
16 an odds ratio of .97.[27] In the Buurman *et al.*[30] study, the participants were at risk of functional decline
17 as measured with the Seniors at Risk-Hospitalized Patients (ISAR-HP), and the high level of acuity of
18 all participants in that study may have influenced the rehospitalization rates. As previously described,
19 the intervention in the Dhalla *et al.*[27] study was relatively brief with just a few weeks of transitional care
20 support provided.

21 In Table 5, we present results from studies that examined the impact of transitional care interventions
22 on rehospitalization rates over times within the same study. Coleman *et al.*[2] found that the IG had lower
23 hospital readmission rates than control participants at each time interval of 30, 90, and 180 days.
24 However, the differences between groups were statistically significant at 30 days and at 90 days, but
25 not at 180 days. In a separate study, Coleman *et al.*[38] found that the IG was significantly less likely to
26 be rehospitalized at 30, 90, and 180 days compared to the CG. Parry *et al.*[39] found that the IG had lower
27 hospital readmission rates than the CG at the 3 time periods examined (30 day, 90 day, and 180 day),
28 but the differences were statistically significant between groups at 90 days only. Wong *et al.*[24] found
29 that the IG had lower hospital readmission rates, but the only significant difference was lower rates of
30 hospital readmission within 28 days for the home visit intervention arm versus the CG. There was no
31 significant difference for either treatment arm and the CG for the mean days of readmission stay at
32 either 28 or 84 days. In two studies, no statistically significant differences emerged at various times
33 points.[27,35] Dhalla *et al.*[27] found no statistically significant differences in hospital readmission at any of
34 the 4 time periods examined: 30 days, 90 days, 180 days, and 1 year. Linden *et al.*[35] found no
35 statistically significant differences in either 30 day or 90 day hospital readmission rates between IG and
36 CG. For these two studies, the length of the interventions were relatively brief following hospital
37 discharge.[27,35]

Researchers also reported the impact of the transitional care intervention on hospitalization for the length of hospitalization and the total number of hospital admissions using various measures. In Table 6, we include the impact of transitional care on the length of hospitalization. These data were reported in various ways across the 7 studies. While the difference was not significant in all studies, hospitalization was shorter for the IG compared to the CG for all studies except for Gagnon et al. [28] In that study, the participants were quite elderly with a mean of 81 for the IG and 82 for the CG, and a 40% probability of hospital admission was an inclusion criteria for participation in the study.

In Table 7, we include the impact of transitional care on the number of hospital admissions. This was reported in various ways across 9 studies, such as total hospitalizations or the percent of participants with a hospital admission within a time period. While the difference was not significant in all studies, there were fewer hospitalizations in the IG versus the CG in most studies. In 3 studies, the differences between groups were very small,[28,33,34] and in 1 study, the IG experienced more hospital admissions[30] In these four studies, the participants were relatively elderly and/or were at high risk for hospital admissions. For example, participants in the Buurman et al.[30] study were at risk of functional decline as measured with the Seniors at Risk-Hospitalized Patients (ISAR-HP). Also, in the Boult et al.[33] study, inclusion criteria for participants included having a high risk for generating high health care expenditures.

Emergency department usage

Fourteen of the included studies reported the impact of transitional care on ED usage using various measures. We identified two ways that these data were reported. We first present results focused on the percent of participants who had one or more ED visits within various time periods. Second, we present results that report the rate of ED usage.

In Table 8, we included results from 5 studies that reported the percent of participants who experienced at least one ED visit within various time periods from 28 days to 12 months. The only significant difference was in the study by Coleman et al.[38] who found that significantly fewer participants (7.4%) in the IG had at least 1 ED visit at 90 days compared to the CG. In this study[38], the researchers reported either an ED or observation unit visit, and they did not find significant differences between the IG and CG at 30 days or 180 days.

In Table 9, we included results from 7 studies that reported the rate of participants who used the ED. These data were reported in various ways including time periods or the length of the whole study. In some cases, ED rates are reported per person. The only study resulting in significantly reduced ED visits in the IG was by Wong et al. [26] who found an 11.1% decreased ED usage at 8 weeks compared to the CG. This was an interesting finding as the duration of the intervention in this study lasted 1 month.[26] In the Gagnon et al.[28] study, there was a significantly higher mean number of ED visits in the IG versus the CG, with 0.3% higher mean ED rate per person over 10 months for the IG versus the CG.

Primary care/physician usage

1   In table 10, we include results of 8 studies that reported the impact of transitional care on primary care

2   or physician usage. In 6 of the studies, there was no significant difference between the IG and the CG,

3   and in 2 studies, primary care or physician usage was higher for the IG. Altfeld *et al.* [42] found that the

4   IG patients were significantly more likely than usual care patients to have had a physician visit within

5   30 days of discharge, even though the intervention in this study was quite brief with a mean duration of

6   just 5.8 days. Shannon *et al.* [43] found that those who received the intervention were twice as likely to

7   use primary care as the CG. In this study,[43] the intervention lasted one year and the Social Workers

8   providing transitional care specifically supported accessing referred services.

9   *Nursing home usage*

10 In table 11, we include results of 5 studies that reported the impact of transitional care on nursing home

11 usage. There were no significant differences in the rates of nursing home admissions for the IG and the

12 CG. In some studies, such as Boult et al.[33], very few participants used nursing home care (n=14), so

13 these results should be interpreted with caution. Relatively high rates of nursing home admission for

14 both the IG and CG were reported in two studies.[30,34] In the Buurman *et al.*[30] study, the participants

15 were at risk of functional decline as measured with the Seniors at Risk-Hospitalized Patients (ISAR-

16 HP). In the Newcomer *et al.*[34] study, participants were quite elderly with a mean age of 82 for the IG

17 and 81.7 for the CG. In this study,[34] participants could be younger, but had to have at least one

18 qualifying health condition (e.g. chronic obstructive pulmonary disease, coronary disease).

19 *Home health care usage*

20 In 4 of the included studies in Table 12, home health care usage was measured as an impact of the

21 transitional care intervention. In 3 of the 4 studies, there was a significant decrease in the number of

22 visits by home health care staff for the IG versus the CG including.[33,36,41] In the Ekdahl *et al.* study,[31]

23 there was no significant difference between the IG and CG for the mean cost of hospital-based home

24 health care. This study[31] was conducted in Sweden where extensive home health care was available

25 to both the IG and CG.

26 *Subgroup analysis of the length of the intervention on health system usage*

27 As our findings indicated a great deal of variation in how the transitional care programs were

28 implemented, a subgroup analysis was warranted. One of the key variations between programs is the

29 length of time that transitional care is provided in the included studies from less than 1 month to 3 years.

30 The length of the intervention has been identified by others as an important variable to examine due to

31 the direct relationship of the length of the intervention on the cost of the intervention.[16,33] In Table 13,

32 we present an analysis of the results of the included studies for three subgroups: interventions of 1

33 month or less (N=10); interventions of more than 1 month to 12 months (N=10); and intervention length

34 of more than 1 year to 3 years (N=3). These results indicate that the variation in the length of time of

35 the interventions has little impact on the impact of the interventions on health system utilization

36 **Discussion**

A distinct challenge in conducting this systematic review was the wide variation in the interventions In this systematic review, we highlighted the variations in the transitional care services provided, who provided transitional care, the type of contact provided, the amount of support provided, and the length of the intervention. These variations certainly impede the strength of recommendations that can be drawn across studies. Nevertheless, there was sufficient homogeneity to allow meta-analysis of rehospitalization data for 3 time periods.

Due to the variations in the interventions, we conducted a subgroup analysis of the impact of the interventions on health system utilization by the length of time of the intervention. This results indicated that those interventions that were relatively brief, that is one month or less, we as effective in reducing expensive forms of health care such as hospital usage as interventions of several months to three years. This is a key finding as our results indicate that longer transitional care interventions may result in higher costs to implement and not yield savings for the health system.

Of the 5 outcomes examined, the impact of transitional care programs on rehospitalization was the most commonly measured across studies. Findings of this review indicate that there is evidence that transitional care programs reduce hospital usage for older people. The largest impact was a reduction in 30 day rehospitalizations with a slightly smaller impact on overall reduction in rehospitalizations at 90 and 180 days. The data reported most consistently across the 23 included studies was 30 day rehospitalizations, although just 10 studies reported on this outcome. Wide variations in the way that data was reported and variables reported greatly limited our ability to conduct meta-analysis. As such, we were only able to conduct meta-analysis for 30, 90, and 180 day rehospitalizations. A total of 5 studies conducted longitudinal data collection that provided interesting insights into the impact of transitional care beyond one month.[2,24,27,35,38,39] These studies consistently showed trends in transitional care reducing rehospitalization over time, although these differences were not always statistically significant, and the greatest impact was found at 30 days.

Since the creation of the Affordable Care Act in the USA in 2010, several transitional care programs have been established to support chronically ill adults with various health transition needs, and these programs primarily focus on reducing hospital readmissions[20] As there are financial incentives for hospitals if patients are not rehospitalized within 30 days, there is much focus in the USA on identifying patients at risk for readmission and introducing programs to reduce rehospitalizations within 30 days. This legislation in the USA had an impact on the availability of data to synthesize for this variable. There was less focus in the studies conducted in other countries on this particular outcome of transitional care programs.

After the impact of transitional care on hospital readmission, ED usage was the second more commonly reported health system outcome reported in the included studies. However, we were not able to conduct meta-analysis due to variations in the ways this data was recorded. We were able to identify two broad ways in which these data were recorded, the proportion of participants with at least one ED visit within various time periods, and measures of the intensity of ED usage within various time periods. The data

indicated very little impact of transitional care on the ways ED usage was measured.

The impact of transitional care on nursing home usage was also measured in various ways across 5 studies. Although only scant evidence was available, the results indicated no impact of transitional care on nursing home usage. In some studies, very few participants were admitted to nursing homes, and this needs to be considered in interpreting the results. A few studies had quite high nursing home admission rates, which were likely a result of these studies including participants with high acuity levels at baseline.

Results from the studies reporting the impact of transitional care on primary care or physician usage indicate that transitional care either increased the use of these health services or had no significant effect. These results indicate an important outcome of transitional care may be greater access to preventative care and could thus reduce utilization of more expensive health services.

The impact of transitional care on home health care usage yielded interesting results. While only 4 studies reported the impact of transitional care on home health care, a finding across these studies was that those receiving transitional care utilized home care at lower levels than the CG. Potentially, the supports provided by transitional care, such as information and referral services, may provide a type of substitution for home care services, or some aspects of home care.

Conclusion

Based on a review of 23 studies conducted in the USA, Hong Kong, Canada, Germany, the Netherlands, Sweden, and Switzerland, we identified four major conclusions First, transitional care reduces rehospitalization rates over time, with the largest effects seen at 30 days. Second, transitional care may increase the utilization of primary care services and thus have a favourable impact on preventative care. Third, transitional care may reduce home health usage. Fourth, transitional care interventions of one month or less appear to be as effective as longer interventions in reducing hospital usage.

Implications for practice

The results of this review can help to guide clinical practice in several ways. Evidence showing that transitional care programs can reduce rehospitalization at 30, 90, and 180 days was moderate in quality. This finding indicates that that these programs are promising approaches to reducing expensive health care services, and in particular hospital admissions Investment in expanding transitional care programs could have a significant impact on reducing hospital costs.

The results indicated that older adults who have very high levels of acuity at baseline may not have a reduction in health system usage. This suggests that the screening processes for eligibility for transitional care programs should take into consideration methods to identify those older adults who have significant health concerns but are still able to benefit from the supports provided through transitional care.

1 Results from a small number of low quality studies indicated that transitional care could increase the use of primary care services. Health care professionals who develop and implement transitional care programs can examine ways to support older adults in increasing their utilization of preventive health care services.

While the evidence was low in quality and only represented 4 studies, we identified interesting trends in transitional care reducing home health care usage. It is possible that some aspects of services provided by transitional care and home care programs could overlap. Efforts should be made to ensure that services are not duplicated when older adults access a variety of supports simultaneously. The context in which transitional care is provided needs to be considered. For example, in some countries with extensive home and community-based supports, the need for transitional care may be reduced.[31]

Implications for research

The existing evidence of the impact of transitional care on the health system is heterogeneous and lacks comparability and consistency. This issue has been identified in prior reviews,[4,17] and this issue remains a concern. Efforts are needed to standardize what outcomes are measured, how data are collected, and how results are recorded in published research.

A limitation of this study is that we focused only on the impact of transitional care on health system outcomes using quantitative indictors. A cost-benefit analyses of transitional care programs is warranted to determine if positive outcomes on the health system outweigh the financial cost of implementing transitional care programs. Other outcomes are also important and should be reviewed, such as quality of life and outcomes for unpaid caregivers of older adults. Qualitative results can provide insights into various aspects of the outcomes of transitional care programs. Replication studies are needed to evaluate transitional care programs composed of the same intervention(s).

While collecting 30 day rehospitalization rates is important, and this is a particular focus within the USA, the impact of transitional care over time is an important outcome to measure. Thus, the inclusion of longitudinal research should be an emphasis of future research.

Finally, examinations of how transitional care programs have an impact on various aspects of the health system are warranted. While we found some evidence on outcomes of transitional care on primary care and home care, additional research on these outcomes will add to existing scant evidence of how the support provided through transitional care can increase the use of preventatives health services.

Conflict of interest

None

Acknowledgements

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13
14

1 **Appendix I: Search strategy**

2

Medline Search Strategy – Last searched on May 5, 2016	
1	"continuity of patient care"/ or patient handoff/
2	(continuity adj3 (care or service* or program* or support)).mp.
3	1 or 2
4	Homes for the Aged/ or Housing for the Elderly/ or Independent Living/
5	((communit* or home or independent$) adj3 (living or dwelling or assisted or assistance)).mp.
6	4 or 5
7	3 and 6
8	((transition or transitional or transfer) adj3 (care or service$ or program$ or support)).mp.
9	7 or 8
10	Geriatric Assessment/ or Nursing Homes/ or Frail Elderly/ or Cognition Disorders/di, ep or Alzheimer Disease/ or exp Aged/
11	(elderly or community-dwelling or geriatric or "mini-mental state" or alzheimer or alzheimer's or alzheimers or mmse or caregivers or falls or adl or frailty or gds or ageing or aging or aged or senior or elders or frail or mci or demented or psychogeriatrics or "cognitive impairment" or "postmenopausal women" or comorbidities or dementia).ti,ab.
12	10 or 11
13	9 and 12

3

CINAHL Search Strategy – Last searched on May 5, 2016	
1	(MH "Continuity of Patient Care") OR (MH "Transfer, Discharge") OR (MH "Hand Off (Patient Safety)")
2	continuity N3 (care or service* or program* or support)
3	1 or 2
4	(MH "Housing for the Elderly") OR (MH "Community Living+")
5	(communit* or home or independent*) N3 (living or dwelling or assisted or assistance)
6	4 or 5
7	3 and 6
8	(transition or transitional or transfer) N3 (care or service* or program* or support)

9	7 or 8
10	(MH "Geriatric Assessment+") OR (MH "Nursing Homes+") OR (MH "Aged+") OR (MH "Frail Elderly") OR (MH "Cognition Disorders/DI/EP") OR (MH "Alzheimer's Disease")
11	TI (elderly or community-dwelling or geriatric or "mini-mental state" or alzheimer or alzheimer's or alzheimers or mmse or caregivers or falls or adl or frailty or gds or ageing or aging or aged or senior or elders or frail or mci or demented or psychogeriatrics or "cognitive impairment" or "postmenopausal women" or comorbidities or dementia) OR AB (elderly or community-dwelling or geriatric or "mini-mental state" or alzheimer or alzheimer's or alzheimers or mmse or caregivers or falls or adl or frailty or gds or ageing or aging or aged or senior or elders or frail or mci or demented or psychogeriatrics or "cognitive impairment" or "postmenopausal women" or comorbidities or dementia)
12	10 or 11
13	9 and 12

1

Embase Search Strategy – Last searched on May 5, 2016	
1	'clinical handover'/de
2	continuity NEAR/3 (care or service* or program* or support)
3	1 or 2
4	'home for the aged'/exp OR 'independent living'/exp
5	(communit* or home or independent*) NEAR/3 (living or dwelling or assisted or assistance)
6	4 or 5
7	3 and 6
8	'transitional care'/exp
9	(transition or transitional or transfer) N3 (care or service* or program* or support)
10	8 or 9
11	7 or 10
12	('geriatric assessment'/exp OR 'nursing home'/exp OR 'frail elderly'/exp OR 'alzheimer disease'/exp OR 'aged'/de OR 'very elderly'/exp) OR ('cognitive defect'/de AND ('diagnosis'/lnk OR 'epidemiology'/lnk))
13	elderly:ab,ti OR 'community dwelling':ab,ti OR geriatric:ab,ti OR 'mini-mental state':ab,ti OR alzheimer:ab,ti OR 'alzheimer s':ab,ti OR alzheimers:ab,ti OR mmse:ab,ti OR caregivers:ab,ti OR falls:ab,ti OR adl:ab,ti OR frailty:ab,ti OR gds:ab,ti OR ageing:ab,ti OR aging:ab,ti OR aged:ab,ti OR senior:ab,ti OR elders:ab,ti OR frail:ab,ti OR mci:ab,ti OR demented:ab,ti OR psychogeriatrics:ab,ti OR 'cognitive impairment':ab,ti OR 'postmenopausal women':ab,ti OR comorbidities:ab,ti OR dementia:ab,ti

| 14 | 12 or 13 |
| 15 | 11 and 14 |

1

2
3

4

Created by XMLmind XSL-FO Converter.

Appendix II: Excluded studies

Anderson, Cheryl, B.V. Deepak, Yaw Amoateng-Adjepong, and Stuart Zarich. Benefits of Comprehensive Inpatient Education and Discharge Planning Combined With Outpatient Support in Elderly Patients With Congestive Heart Failure. *Congestive Heart Failure* 11.6 (2005): 315-21.

> **Reason for exclusion: Problematic method of selecting comparison sample, small sample size**

Beck, Anne Marie, Stine Kjær, Birthe Stenbæk Hansen, Rikke Lunau Storm, Kirsten Thal-Jantzen, and Christian Bitz. Follow-up Home Visits with Registered Dietitians Have a Positive Effect on the Functional and Nutritional Status of Geriatric Medical Patients after Discharge: A Randomized Controlled Trial. *Clinical Rehabilitation* 27.6 (2013): 483-93.

> **Reason for exclusion: Problems with statistical analsyis and variations in how the intervention was implemented**

Berry, Donna, Costanzo, Diane, Elliott, Brenda, Miller, Andrew, Miller, Judith, Quackenbush, Patricia, and Su, Ya-Ping. Preventing Avoidable Hospitalizations: Implementing the Transitional Care Model in Home Care Utilizing Evidence-Based Practice." *Home Healthcare Nurse* 29.9 (2011): 540

> **Reason for exclusion: Random sampling was not used, not enough research evidence was included about the study outcomes**

Boult, Chad, Bruce Leff, Cynthia Boyd, M. Wolff, Jennifer Marsteller, L. Frick, Jill Wegener, A. Reider, Kevin Frey, D. Mroz, Stephen Karm, and Lisa Scharfstein. A Matched-Pair Cluster-Randomized Trial of Guided Care for High-Risk Older Patients. *Journal of General Internal Medicine* 28.5 (2013): 612-21.

> **Reason for exclusion: This study used the same dataset as another included study.[33] The excluded article included less detail and was less relevant to our outcomes of interest than the included study.**

Bretz, Miranda N, Alex Graves, Angie West, Karen C Kiesz, Lynn Toth, and Marie Welch. Steps against Recurrent Stroke Plus: Patient Transition Program. *The Journal of Neuroscience Nursing: Journal of the American Association of Neuroscience Nurses* 46.4 (2014): E3-13.

> **Reason for exclusion: The sample included an age range of 24-92 with over half of the sample under age 60. Random sampling was not used.**

Brand, Caroline A, Catherine T Jones, Adrian J Lowe, David A Nielsen, Carol Roberts, Bellinda A L King, and Donald A Campbell. A Transitional Care Service for Elderly Chronic Disease Patients at Risk of Readmission. *Australian Health Review* 28.3 (2004): 275-84.

> **Reason for exclusion: There were some large differences between groups at baseline and analysis was not done to address these differences.**

Brock, Jane, Jason Mitchell, Kimberly Irby, Beth Stevens, Traci Archibald, Alicia Goroski, and Joanne Lynn. Association between Quality Improvement for Care Transitions in Communities and Rehospitalizations among Medicare Beneficiaries. *JAMA* 309.4 (2013): 381-91.

Reason for exclusion: Not enough detail is included in describing the methods used. A wide variety of interventions were used, and they ranged widely across study sites.

Comans, Tracy A., Nancye M. Peel, Ian D. Cameron, Leonard Gray, and Paul A. Scuffham. Healthcare Resource Use in Patients of the Australian Transition Care Program. *Australian Health Review* 39.4 (2015): 411-16.

Reason for exclusion: No comparison or pre-post data was included in the study. Sampling was not random. Confounding factors were not identified.

Daley, Cathleen M. A Hybrid Transitional Care Program. *Critical Pathways in Cardiology* 9.4 (2010): 231-4.

Reason for exclusion: There were important differences between the treatment and comparison groups. The treatment group met criteria for high-risk admission. Only descriptive results were included.

Deniger, Troller, and Kennelty. Geriatric Transitional Care and Readmissions Review. *The Journal for Nurse Practitioners* 11.2 (2015): 248-52.

Reason for exclusion: Demographic data of participants was not included. Little detail is included about the intervention. Information about people who withdrew was not included.

D'Souza, Maria F., Judith Davagnino, S. Nicole Hastings, Richard Sloane, Barbara Kamholz, and Jack Twersky. Preliminary Data from the Caring for Older Adults and Caregivers at Home (COACH) Program: A Care Coordination Program for Home-Based Dementia Care and Caregiver Support in a Veterans Affairs Medical Center. *Journal of the American Geriatrics Society* 63.6 (2015): 1203-208.

Reason for exclusion: The comparison group was extremely small compared to the treatment group. Confounding factors were not controlled for.

Enguidanos, S., Gibbs, N., Jamison, P. From hospital to home: A brief nurse practitioner intervention for vulnerable older adults. Journal of Gerontological Nursing 38.3 (2012): 40-50.

Reason for exclusion: Information was not included on those who withdrew from the study. The small sample size resulted in insufficient power for statistical analysis.

Fleming, Michael O, and Tara Trahan Haney. Improving Patient Outcomes with Better Care Transitions: The Role for Home Health. *Cleveland Clinic Journal of Medicine* 80 Electronic Suppl 1 (2013): ES2-6.

Reason for exclusion: Sufficient details about the methods used were not provided including sample selection, inclusion criteria, and information on those who withdrew.

1 Gräsel, E., R. Schmidt, J. Biehler, and W. Schupp. Long-term Effects of the Intensification of the
2 Transition between Inpatient Neurological Rehabilitation and Home Care of Stroke Patients. *Clinical*
3 *Rehabilitation* 20.7 (2006): 577-83.

4 **Reason for exclusion: Telephone interviews versus accessing health system data was**
5 **used to collect data on health system utilization. The sample size was quite small.**

6 Gurwitz, Jerry H., Terry S. Field, Jessica Ogarek, Jennifer Tjia, Sarah L. Cutrona, Leslie R. Harrold,
7 Shawn J. Gagne, Peggy Preusse, Jennifer L. Donovan, Abir O. Kanaan, George Reed, and Lawrence
8 Garber. An Electronic Health Record–Based Intervention to Increase Follow-Up Office Visits and
9 Decrease Rehospitalization in Older Adults. *Journal of the American Geriatrics Society* 62.5 (2014):
10 865-71.

11 **Reason for exclusion: Intention to treat analysis was not conducted.**

12 Harrison, Margaret B., Gina D. Browne, Jacqueline Roberts, Peter Tugwell, Amiram Gafni, and Ian
13 Graham. Quality of Life of Individuals with Heart Failure: A Randomized Trial of the Effectiveness of
14 Two Models of Hospital-to-Home Transition. *Medical Care* 40.4 (2002): 271-82.

15 **Reason for exclusion: The intervention was specific to treating a disease after**
16 **hospitalization versus providing transitional care. The small sample size resulted in**
17 **insufficient power for statistical analysis.**

18 Hendrix, Cristina, Sara Tepfer, Sabrina Forest, Karen Ziegler, Valerie Fox, Jeannette Stein, Eleanor S.
19 McConnell, Susan Nicole Hastings, Kenneth Schmader, and Cathleen Colon-Emeric. Transitional Care
20 Partners: A Hospital-to-home Support for Older Adults and Their Caregivers. *Journal of the American*
21 *Association of Nurse Practitioners* 25.8 (2013): 407-14.

22 **Reason for exclusion: As a clinical demonstration project, the sample size was quite**
23 **small and tests of significant differences between groups were not conducted.**

24 Kind, Amy J. H., Maria Brenny-Fitzpatrick, Kris Leahy-Gross, Jacquelyn Mirr, Elizabeth Chapman,
25 Brooke Frey, and Beth Houlahan. Harnessing Protocolized Adaptation in Dissemination: Successful
26 Implementation and Sustainment of the Veterans Affairs Coordinated-Transitional Care Program in a
27 Non-Veterans Affairs Hospital. *Journal of the American Geriatrics Society* 64.2 (2016): 409-16.

28 **Reason for exclusion: Sampling was not random, inclusion criteria were not stated.**
29 **Those who withdrew were not described.**

30 Kind, Amy J H, Laury Jensen, Steve Barczi, Alan Bridges, Rebecca Kordahl, Maureen A Smith, and
31 Sanjay Asthana. Low-cost Transitional Care with Nurse Managers Making Mostly Phone Contact with
32 Patients Cut Rehospitalization at a VA Hospital. *Health Affairs (Project Hope)* 31.12 (2012): 2659-68.

33 **Reason for exclusion: There were wide variations in how the intervention was delivered**
34 **A large majority of participants at baseline did not receive most of the intervention, and**

their characteristics are not described.

Koehler, Bruce E., Kathleen M. Richter, Liz Youngblood, Brian A. Cohen, Irving D. Prengler, Dunlei Cheng, and Andrew L. Masica. Reduction of 30-day Postdischarge Hospital Readmission or Emergency Department (ED) Visit Rates in High-risk Elderly Medical Patients through Delivery of a Targeted Care Bundle. *Journal of Hospital Medicine* 4.4 (2009): 211-18.

Reason for exclusion: This was a pilot study with a very small sample size with 20 people in the IG and 21 people in the CG.

Kwan, Janice L., Matthew W. Morgan, Thomas E. Stewart, and Chaim M. Bell. Impact of an Innovative Inpatient Patient Navigator Program on Length of Stay and 30-day Readmission. *Journal of Hospital Medicine* 10.12 (2015): 799-803.

Reason for exclusion: The intervention primarily occurred pre-hospital discharge with minimal support provided post-discharge.

Logue, Melanie D, and Jennifer Drago. Evaluation of a Modified Community Based Care Transitions Model to Reduce Costs and Improve Outcomes. *BMC Geriatrics* 13 (2013): 94.

Reason for exclusion: Demographic information on participants was not included. Intention to treat analysis was not used.

Meisinger, Christa, Björn Stollenwerk, Inge Kirchberger, Hildegard Seidl, Rupert Wende, Bernhard Kuch, and Rolf Holle. Effects of a Nurse-based Case Management Compared to Usual Care among Aged Patients with Myocardial Infarction: Results from the Randomized Controlled KORINNA Study. *BMC Geriatrics* 13 (2013): 115.

Reason for exclusion: This study used the same dataset as an included study.[29] The excluded article utilized the same study sample, but only included the first year of the study. The included article continued the intervention for an additional two years and then measured the same outcomes.

Mion, Palmer, Meldon, Bass, Singer, Payne, Lewicki, Drew, Connor, Campbell, and Emerman. Case Finding and Referral Model for Emergency Department Elders: A Randomized Clinical Trial. *Annals of Emergency Medicine* 41.1 (2003): 57-68.

Reason for exclusion: This intervention used in this study used extremely minimal post-hospital discharge support that was not comparable to the other included studies.

Morrison, Jessica, Mary Val Palumbo, and Betty Rambur. Reducing Preventable Hospitalizations with Two Models of Transitional Care. *Journal of Nursing Scholarship* 48.3 (2016): 322-29.

Reason for exclusion: There was little description of the characteristics of the participants in the two groups. Confounding factors were not dealt with, such as a large age difference between the two groups. There was no CG, only two IGs. Participants

were not randomized into groups. The comparison group came from a region with lower acute-care utilization rates compared to the IG

Naylor, Mary D., Kathryn H. Bowles, Kathleen M. McCauley, Maureen C. Maccoy, Greg Maislin, Mark V. Pauly, and Randall Krakauer. High-value Transitional Care: Translation of Research into Practice. *Journal of Evaluation in Clinical Practice* 19.5 (2013): 727-33.

Reason for exclusion: Representativeness of the population was not met. Baseline data of the IG was included only. No baseline characteristics of the comparison group was available.

Naylor, Mary D., Karen B. Hirschman, Alexandra L. Hanlon, Kathryn H. Bowles, Christine Bradway, Kathleen M. McCauley, Mark V. Pauly. Comparison of evidence-based interventions on outcomes of hospitalized, cognitively impaired older adults. *J Comp Eff Res* 3.3 (2014): 245-257.

Reason for exclusion: There were three IGs and no CG. The sample was too small to detect impact on health system utilization. A high proportion of those eligible chose not to participate. Challenges may have existed in ensuring the program was implemented consistently.

Neff, Donna Felber, Elizabeth Madigan, and Georgia Narsavage. APN-directed Transitional Home Care Model: Achieving Positive Outcomes for Patients with COPD. *Home Healthcare Nurse* 21.8 (2003): 543-50.

Reason for exclusion: There were large differences between the treatment and CGs that were not addressed statistically. The sample size was very small.

Ohuabunwa, Ugochi, Queenie Jordan, Seema Shah, Michael Fost, and Jonathan Flacker. Implementation of a Care Transitions Model for Low-Income Older Adults: A High-Risk, Vulnerable Population. *Journal of the American Geriatrics Society* 61.6 (2013): 987-92.

Reason for exclusion: A high proportion of those eligible chose not to participate. The sample size was very small

Ong, Michael, Romano, Patrick, Edgington, Sarah, Aronow, Harriet, Auerbach, Andrew, Black, Jeanne, De Marco, Teresa, Escarce, Jose, Evangelista, Lorraine, Hanna, Barbara, Ganiats, Theodore, Greenberg, Barry, Greenfield, Sheldon, Kaplan, Sherrie, Kimchi, Asher, Liu, Honghu, Lombardo, Dawn, Mangione, Carol, Sadeghi, Bahman, Sadeghi, Banafsheh, Sarrafzadeh, Majid, Tong, Kathleen, and Fonarow, Gregg. Effectiveness of Remote Patient Monitoring After Discharge of Hospitalized Patients With Heart Failure: The Better Effectiveness After Transition-Heart Failure (BEAT-HF) Randomized Clinical Trial. *JAMA Internal Medicine* 176.3 (2016): 310.

Reason for exclusion: This intervention included in this study focused on health monitoring and health education about the condition of heart failure post-discharge. It primarily involves tele-monitoring of health status and does not fit the criteria for

transitional care used in the other studies.

Ostrovsky, Andrey, Lori O'Connor, Olivia Marshall, Amanda Angelo, Kelsy Barrett, Emily Majeski, Maxwell Handrus, and Jeffrey Levy. Predicting 30- to 120-Day Readmission Risk among Medicare Fee-for-Service Patients Using Nonmedical Workers and Mobile Technology. *Perspectives in Health Information Management* 13 (2016): 1e.

Reason for exclusion: A large proportion withdrew from the study and they were not accounted for in the analysis.

Peel, Nancye May, Kah Wai Chan, and Ruth Eleanor Hubbard. Outcomes of Cognitively Impaired Older People in Transition Care. *Australasian Journal on Ageing* 34.1 (2015): 53-57.

Reason for exclusion: It was not clear whether outcomes were due to the intervention within the context of this study due to a widely implemented discharge planning program that limits the ability to obtain a control or comparison group.

Peel, Nancye May, Ruth Eleanor Hubbard, and L.C. Gray. Impact of Post-acute Transition Care for Frail Older People: A Prospective Study. (2013): 165-171.

Reason for exclusion: It was not clear whether outcomes were due to the intervention within the context of this study due to a widely implemented discharge planning program that limits the ability to obtain a control or comparison group.

Robinson, Thomas E, Lifeng Zhou, Ngaire Kerse, John DR Scott, Jonathan P Christiansen, Karen Holland, Delwyn E Armstrong, and Dale Bramley. Evaluation of a New Zealand Program to Improve Transition of Care for Older High Risk Adults. *Australasian Journal on Ageing* 34.4 (2015): 269-74.

Reason for exclusion: The sample was not random and a control or comparison group was not used.

Saleh, Shadi S., Chris Freire, Gwendolyn Morris-Dickinson, and Trip Shannon. An Effectiveness and Cost-Benefit Analysis of a Hospital-Based Discharge Transition Program for Elderly Medicare Recipients. *Journal of the American Geriatrics Society* 60.6 (2012): 1051-056.

Reason for exclusion: Intention to treat analysis was not used. Tests of significance were not performed to determine significant differences between groups.

Schraeder, Cheryl, Cynthia W Fraser, Ida Clark, Barbara Long, Paul Shelton, Valerie Waldschmidt, Christine L Kucera, and William K Lanker. Evaluation of a Primary Care Nurse Case Management Intervention for Chronically Ill Community Dwelling Older People. *Journal of Clinical Nursing* 17.11c (2008): 407-17.

Reason for exclusion: There were large variations in characteristics of participants in the treatment and comparison groups and statistical analysis did not account for these differences.

Stauffer, Brett D, Cliff Fullerton, Neil Fleming, Gerald Ogola, Jeph Herrin, Pamala Martin Stafford, and David J Ballard. Effectiveness and Cost of a Transitional Care Program for Heart Failure: A Prospective Study with Concurrent Controls. *Archives of Internal Medicine* 171.14 (2011): 1238-43.

Reason for exclusion: Information on those who withdrew was not included. The process for assignment to groups was not clear.

Takahashi, Paul Y, Lindsey R Haas, Stephanie M Quigg, Ivana T Croghan, James M Naessens, Nilay D Shah, and Gregory J Hanson. 30-day Hospital Readmission of Older Adults Using Care Transitions after Hospitalization: A Pilot Prospective Cohort Study. *Clinical Interventions in Aging* 8 (2013): 729-36.

Reason for exclusion: This was a small pilot study 19 people in the IG and 15 people in the comparison group, and it was not powered sufficiently to identify differences between groups.

Takahashi, Naessens, Peterson, Rahman, Shah, Finnie, Weymiller, Thorsteinsdottir, and Hanson. Short-term and Long-term Effectiveness of a Post-hospital Care Transitions Program in an Older, Medically Complex Population. *Healthcare* 4.1 (2016): 30-35.

Reason for exclusion: Intention to treat analysis was not done. There may have been challenges in implementing the intervention consistently.

Tappen, R M, R F Hall, and S L Folden. Impact of Comprehensive Nurse-managed Transitional Care. *Clinical Nursing Research* 10.3 (2001): 295-313.

Reason for exclusion: Intention to treat analysis was not done. There were some important differences in the characteristics of the two groups.

Vedel, Isabelle, Matthieu Stampa, Howard Bergman, Joel Ankri, Bernard Cassou, Claire Mauriat, François Blanchard, Emmanuel Bagaragaza, and Liette Lapointe. A Novel Model of Integrated Care for the Elderly: COPA, Coordination of Professional Care for the Elderly. *Aging Clinical and Experimental Research* 21.6 (2009): 414-23.

Reason for exclusion: The sample was not random and no control or comparison group was used.

Villars, Dupuy, Soler, Gardette, Soto, Gillette, Nourhashemi, and BrunoVellas. A Follow-up Intervention in Severely Demented Patients after Discharge from a Special Alzheimer Acute Care Unit: Impact on Early Emergency Room Re-hospitalization Rate. *International Journal of Geriatric Psychiatry* 28.11 (2013): 1131-140.

Reason for exclusion: The sample was not random. There was insufficient description of two groups that received different types of interventions

Watkins, Lynn, Carol Hall, and Daria Kring. Hospital to Home: A Transition Program for Frail Older Adults. *Professional Case Management* 17.3 (2012): 117-23.

Reason for exclusion: The sample was not random. Confounding factors were not identified.

Wee, Shiou-Liang, Chok-Kang Loke, Chun Liang, Ganga Ganesan, Loong-Mun Wong, and Jason Cheah. Effectiveness of a National Transitional Care Program in Reducing Acute Care Use. *Journal of the American Geriatrics Society* 62.4 (2014): 747-53.

Reason for exclusion: Intention to treat analysis was not conducted. As a retrospective study, this limited the ability to compare community-based health service usage between the groups.

Williams, Grace, Karen Akroyd, and Linda Burke. Evaluation of the Transitional Care Model in Chronic Heart Failure. *British Journal of Nursing* 19.22 (2010): 1402-7.

Reason for exclusion: The sample was small and limited the generalizability of the results. There were some variations in demographic and clinical characteristics between groups.

Zhao, Yue, and Frances Kam Yuet Wong. Effects of a Postdischarge Transitional Care Programme for Patients with Coronary Heart Disease in China: A Randomised Controlled Trial. *Journal of Clinical Nursing* 18.17 (2009): 2444-455.

Reason for exclusion: Intention to treat analysis was not conducted. Outcome measures relied on self-reporting by the participants.

Appendix III: Characteristics of included studies

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
Randomized Controlled Trials				
Altfeld[42]	Recruited participants post hospital discharge from 1 hospital. Country: USA	N=720 Age 65 and older (mean age of 74.5), mean age of 74.1 for intervention and 75.0 for control, 49% white, discharged from hospital with at least 7 medications and at least one additional criteria (live alone, lacks support system, at risk for falls, at least 1 inpatient admission in 12 months, lacking emotional support, in-depth psychosocial need)	N= 360 Enhanced Discharge Planning Program (EDPP): A Social Work based telephone intervention involving a baseline interview to develop individualized intervention plan; a review of electronic medical records; connected older adults with service providers; followed up with service providers.	N= 380 Conventional care given to all patients discharged from the medical center. No post-discharge contact between hospital staff and patients or caregivers for 30 days.
Balaban[45]	Hospitalized patients recruited from 2 hospitals that served an ethnically diverse and traditionally underserved population Country: USA	N= 1,510 For IG, mean age of 66.4, 40.8% men, 57.6% white For CG, mean age of 63.7, 39.4% men, 57.5% white All had at least 1 of 5 risk factors associated with elevated readmission	N= 585 total (N=425 60+ and N=160 less than 60). Patient Navigator Intervention: Included 1 hospital visit including assessment and service coordination and 3 weekly post-discharge outreach calls including assistance with making appointments,	N=925 Usual inpatient and outpatient care, a case manager organizes post-discharge care, review of discharge instructions prior to discharge, a follow-up phone call within 2 days of discharge

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
			medication support, facilitated communication with care providers, connections to community services, supported self-management, helped with navigating the health system.	
Boult[33] Matched-pair cluster	Recruited patients of 8 community-based primary care practices Country: USA	N=850 Age 65 and older, mean age of 77.5 for total sample, mean age of 77.1 for the intervention and 77.8 for the control, 45.1% men, 51.2% White. Patients recruited had a high risk for generating high health care expenditures (in the highest quartile of the Hierarchal Conditional Category predictive model). Mean of 4.3 chronic diseases	N=446 Guided Care Nurses: Services included monitoring, coaching, coordinating transitions between sites and providers of care, caregiver support, and accessing community resources. Initial assessment was done in the patient's home and then monitoring calls at least monthly. Participants could also call the nurses. An electronic health record was used.	N=404 Usual care
Buurman[30]	Hospitalized patients, recruited from 3 hospitals with affiliated home care	N= 674 Age 65 and older (mean age of 80), 42% men, admitted to hospital for at least 48 hours, at	N=337 Transitional Care Bridge Program: Inpatient Comprehensive Geriatric	N=337 Inpatient Comprehensive Geriatric Assessment, multidisciplinary

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
	organizations and a geriatric consultation team	risk of functional decline as measured with the Seniors at Risk-Hospitalized Patients (ISAR-HP)	Assessment, multidisciplinary inpatient care, visit by a community care RN prior to and after hospital discharge, the RN applied the treatment plan resulting from geriatric assessment.	inpatient care only
Coleman[2]	Recruited hospitalized patients admitted to a contract hospital of a not-for-profit capitated delivery system in Colorado. Country: USA	N=750 Age 65 and older. Mean age of 76.0 for treatment group, 78.4 for CG, 51.7% men for treatment group and 47.7% men for the CG, had at least 1 of 11 diagnoses indicating high care needs following discharge	N=379 The Care Transitions Intervention: 4 pillars: assistance with medication self-management; a patient-centered record owned and maintained by the patient; timely follow-up; and a list of red flags indicative of a worsening conditions and instructions on how to respond to them. Encouraged the patient and caregiver to assert a more active role during care transitions, to provide continuity across settings, and to ensure that the patient's needs were being met	N=371 Usual care

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
			irrespective of the care setting.	
Dhalla[27] parallel group	Recruited patients discharged from 4 hospitals in Toronto Country: Canada	N=1,923 Mean age of 71.2 for treatment group, 71.3 for CG, 51% men for treatment group and 52% men for the CG, at high risk of readmission.	N=963 Virtual Ward: Support included information about services available and a telephone number to call anytime if help is needed. The Care Coordinator made a home visit within a few days of discharge. Subsequent assessment by various methods (i.e. at home, telephone, clinic). Patients were discharged from the virtual ward when the team believed they were ready for discharge or they were unwilling to further engage with the team.	N=960 Usual care prior to discharge. At discharge, patients received a discharge summary and it was sent to the primary care physician, counselling was provided by the health care team, arrangements for home care were made, if needed, recommendations for follow-up care were provided.
Ekdahl[31]	Recruited community-dwelling participants, conducted in Sweden in 1 municipality that included both rural and	N=382 Age 75 and older, mean age of 82.5, 52% men, community-dwelling had 3 more concomitant medical diagnoses, received inpatient hospital	N=208 Ambulatory Geriatric Assessment: A Frailty Intervention Trial (Age-FIT): Comprehensive geriatric assessment and follow-up in an ambulatory geriatric	N=174 The CG received usual social and health care delivered at home, in primary care centers, and in the hospital. Any care received

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
	urban areas Country: Sweden	care 3 or more times in the previous 12 months	unit. Individually tailored care and follow-up visits at the ambulatory geriatric unit that included home visits, participants' visits to the ambulatory geriatric unit, and/or telephone calls.	was usually provided after patients or family members contacted social and health workers, rather than at the initiative of health care professionals.
Gagnon[28]	Recruited older adults who had been discharged from the ED to home from a hospital in Montreal in the previous 12 months. Country: Canada	N=427 Recruited community-dwelling adults age 70 and older, needed help with at least 1 ADL or 2 IADLs and 40% probably of readmission to hospital. Mean age of 81.4 for treatment group, 81.8 for CG, 42.9% men for treatment group and 40.9% men for the CG	N=212 Nurse Case Management: Nurses supported older adults and their caregivers during times of transition related to health status, environmental changes and changes in resource needs. The Nurse Case Manager coordinated the work of all healthcare providers involved in the case. Baseline data were collected through home visits. Care plans focused on responding to strengths and coping abilities while encouraging maximal autonomy.	N=215 Usual care by hospital and/or community services

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
Imhof[32]	Participants lived in a major city in a German-speaking part of Switzerland. They were recruited through invitations by health and social service organizations Country: Switzerland	N=461 Recruited community-dwelling people age 80 and older. Mean age of 85 for treatment group and 85 for CG, 27.2% men for treatment group and 27% for the CG.	N=231 Health Consultation Program: The intervention was customized to the participants' needs to address the health problems identified and the concerns the participants wished to focus on including how to best make use of the health care system. At the end of each home visit, participants developed an action plan.	N=230 Usual care provided by community health nurses and physicians that is covered by the participants' health insurance.
Kirch-berger[29]	Recruited hospitalized patients discharged to home from a hospital in Augsburg, Germany. Country: Germany	N=329 Age 65 and older who were diagnosed with acute myocardial infarction and discharged home. Mean age of 75.2 for treatment group and 75.6 for CG, 62.7% men for treatment group and 61.3% for the CG.	N=161 The KORINNA (Coronary Infarction follow-up in the elderly): The intervention was a combination of case management (identification of individual care problems, coordination of health care measures) and disease management (support of risk factor management, information and individual education).	N=168 Usual care possibly including in-hospital cardiac rehabilitation or a participation in a disease-management program offered by a health insurance company. Contacted by telephone every 3 months in the first year and once per year in years 2 and 3.

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
			Baseline assessment occurred in the hospital to develop an individualized intervention followed by a combination of telephone calls and home visits according to patient need and patient risk level.	Assessment and examination in the hospital after 1 year and a final assessment after 3 years.
Linden[35]	Recruited patients discharged to home from 2 hospitals in Oregon. Country: USA	N=512 Diagnosis of congestive heart failure or chronic obstructive pulmonary disease. Mean age of 65.81 for treatment group, 67.67 for CG, 43.9% men for treatment group and 40.9% for the CG.	N=253 1) Pre-discharge components: patient education, discharge planning, medication reconciliation, follow-up appointments scheduled); 2) Post discharge components: timely follow-up, follow-up telephone call, availability of patient hotline, motivational interviewing-based health coaching, symptom monitoring using interactive voice response (daily symptom monitoring up to 30 days post discharge) 3) Bridging components: transition/health coach, patient-centered discharge	N=259 Usual care, brief patient education and discharge planning delivered in the traditional medical model.

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
			instruction.	
Naylor[36]	Recruited patients discharged to home from 6 Philadelphia academic and community hospitals Country: USA	N=239 Age 65 and older, diagnosis of heart failure. Mean age of 76.4 for treatment group, 75.6 for CG, 40% men for treatment group and 44% for the CG, 66% white for the treatment group and 62 for the CG	N=118 1) Multidisciplinary advanced practice nurse orientation and training program, 2) identification of patients' and caregivers' goals, individualized plans of care developed and implemented, continuity of care and care coordination across settings, 3) implementation of an evidence-based protocol with a unique focus on comprehensive management of needs.	N=121 Routine care for the admitting hospital, including site-specific heart failure patient management and discharge planning, and if referred, home care
Naylor[41]	Recruited patients admitted to a hospital in Pennsylvania and discharged to the geographic area. Country: USA	N=363 Age 65 and older and had at least 1 criteria associated with poor discharge outcomes. Mean age of 75.5 for treatment group, 75.3 for CG, 54% men for treatment group and 46% for the CG, 56% white for the treatment group and 54 for the CG	N=177 Individualized discharge planning and home follow-up including physical and environmental assessments, targeted efforts at increasing patients' and caregivers' availability to manage unresolved health problems, coordination of home	N=186 Usual care

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
			services, and collaboration with physicians.	
Newcomer[34]	Recruited participants who were receiving primary care from a Sharp Health care – an affiliated medical group in San Diego. Country: USA	N=3,079 Age 80 or older or at least age 65 with at least one qualifying health condition (e.g. chronic obstructive pulmonary disease, coronary disease). Mean age of 82.0 for treatment group, 81.7% for CG; 40% men for treatment group and 39.6% for the CG; 88.5% white for the treatment group and 87.2% for the CG	N=1,537 Enhanced Case Management (EMC): 1) Health screening and care planning, 2) Monitoring of individual status and care planning effectuation. 3) Support provided by telephone, provided educational materials by mail, referrals to plan-covered benefits and to community-based programs, assistance with using services. 4) Treatment adherence monitoring and support	N=1,542 Usual care Were eligible for Sharp Health care's preexisting post-hospital case management programs.
Parry[39]	Participants were recruited from patients of a not-for-profit senior care clinic in Colorado who were hospitalized and discharge to home. Country: USA	N=98 Over age 65, mean age of 80.5 for treatment group, 82.8% for CG; 24.5% men for treatment group and 38.8% for the CG; 87.8% white for the treatment group and 89.8% for the CG	N=49 The Care Transitions Intervention: The intervention is based on 4 pillars: assistance with medication self-management; a patient-centered record owned and maintained by the patient; timely follow-	N=49 Usual care consisted of standard discharge planning offered by a hospital. They did not receive post-hospital outreach.

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
			up with primary or specialty care; and a list of red flags indicative of a worsening conditions and instructions on how to respond to them.	
Shannon[43]	Recruited participants who were patients of a health services company, 2 social service agencies, and 4 medical groups in Southern California. The Care Advocates who worked in offices provided by the community-based social service agencies. Country: USA	N=705 Over age 65, minimum of 1 year in a Medicare –risk health plan, assessed to have high health care service utilization in the future There were no significant differences in age or sex between groups (demographic data is not included).	N=271 The Care Advocate Program: An Initial assessment is done by phone or in-person and a letter is sent with results of the assessment and support provide, follow-up phone call after 1 week and then monthly, help with accessing referred services. Participants were encouraged to contact the Care Advocates at any time, if they wished. Additional referrals at the end.	N=434 Usual care
Wong[26]	Recruited patients discharged home from 3 regional hospitals with	N=108 Mean age of 69.5, 37% men who were stroke survivors.	N=54 Pre-discharge holistic assessment and care planning was followed by events that occurred each	N=54 Received a routine hospital-based physical training program offered within the

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
	the same cluster in Hong Kong. Country: Hong Kong		week for 4 weeks post-discharge including family meetings, home visits and telephone calls. Mutual health goals were set between the client and the nurse.	first 3 weeks of hospital discharge. The therapist would assess the patients in the first training session and might offer follow-up sessions if appropriate.
Wong[24] Compared home visits with calls and calls alone with a 4 week transitional care program	Recruited medical patients with chronic conditions discharged from a regional acute care hospital. Country: Hong Kong	N=610 Community-dwelling, median age of 76.5, 47.5% males. A primary diagnosis related to respiratory, diabetic, cardiac and renal conditions	N=400 Pre-discharge assessment followed by the Home Visit Arm received home visits from a Nurse the 1st and 3rd weeks and calls the 2nd and 4th weeks. The Call Arm received calls from the Nurse in weeks 1 and 4 and from nursing students in weeks 2 and 3. The Nurse Care Managers set mutual goals with the patients so that they would take up an active role in managing their own health.	N=210 Received two placebo social calls within the program period of 4 weeks.
Yu[25]	Recruited patients from a university-affiliated	N=178 Age 60 and older diagnosed with chronic heart failure	N=90 1) Predischarge visit and assessment, 2) Two weekly home	N=88 Usual care included pharmacy

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
	hospital. Country: Hong Kong	who were discharged home. Mean age of 78.6 for the treatment group and 78.7 for the CG. 53% male in the treatment group and 36.4% male in the CG.	visits to assess chronic heart failure status and self-care implementation at home, customized educational and supportive interventions to enable self-care, 3) Intensive telephone follow-up calls were made 1 week after the 2nd home visit, then every 2 weeks for 3 months, and then every 2 months for 6 months. Further home visits were offered and participants had telephone access to the nurse.	dispensers giving brief instructions when participants collected prescribed medications on hospital discharge. A regular medical consultation at the specialist clinic was arranged 4-6 weeks after discharge. No structured educational or supportive post-discharge care was provided.
Comparable Cohort/Case Control Studies				
Coleman[38]	Recruited hospitalized patients admitted to a contract hospital of a not-for-profit capitated delivery system. Intervention patients were recruited	N=1,393 Age 65 and older. Mean age of 75.1 for treatment group, 78.5 for CG, 46.3.% men for treatment group and 44.6% men for the CG, had at least 1 of 9 diagnoses indicating high care needs following discharge	N=158 4 pillars: assistance with medication self-management; a patient-centered record owned and maintained by the patient; timely follow-up; and a list of red flags indicative of a worsening conditions and instructions on how to respond to	N=1,235 Usual care

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
	directly from the hospital. Control patients were recruited from the health delivery system's administrative records. Country: USA		them. Encouraged the patient and caregiver to assert a more active role during care transitions, to provide continuity across settings, and to ensure that the patient's needs were being met irrespective of the care setting.	
Gardner[44] The CG was made up of those who were eligible to participate but were lost to follow-up before completing a home visit (internal control)	Recruited hospitalized patients from 6 acute care hospitals with planned discharges to the community. Country: USA	N=642 Mean age of 76 for treatment group, 76 for CG, 36.8% male for the treatment group, 38.9% male for the CG, 92% white for both groups.	N=321 The Care Transitions Intervention: Patient-centered coaching intervention to empower patients to better manage their health and to communicate more effectively with their providers. A trained Transitions Coach focused on skills transfer for a core set of transition-related skills, such as a using a personal health record, making follow-up appointments and responding to worsening signs and symptoms.	N=321 Usual care

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
Hamar[37] Retro-spective, matched nonpartic-ipant group	Recruited hospitalized patients, Data drawn from 14 acute care hospitals in Texas Country: USA	N=3900 Mean age of 69.1 for treatment group, 69.5 for CG 45.5% male for both groups Identified hospitalized patients with at least 1 readmission-sensitive conditions (i.e. heart failure, COPD, pneumonia)	N=560 Care Transition Solution (CTS): In-hospital comprehensive assessment, medication reconciliation before and after hospital discharge, provision and review of a patient-oriented care transition record with documented discharge plan, coordination of medical providers and service agencies for post-discharge care, tracked and supported patients recovery and ongoing self-management and encouraged discharge plan adherence.	N=3340 Usual care
Stranges[40]	Recruited patients discharged from the health system's primary hospital to home or assisted living. The program	N=1,144 Age 60 and older. As treated group: Mean age of 81 for treatment and CGs, 31.8% male for the treatment group and 35.8% male for the CG, over 80% white	N=572 (ITT) N=217 (per protocol N=217 (as treated group) Discharge planning, medication reconciliation and review 2-4 days after hospital discharge, use of an electronic	N= 572 (ITT) N=572 (per protocol) N=927 (as treated group) Usual care

Study	Setting	Participants	Intervention A - Treatment	Intervention B - Control
	operated from a geriatrics clinic as part of a large academic health system. Country: USA		medical record, and visit to clinic 1 week after discharge for a Geriatric Assessment and Social Worker support, home visits and intensive follow-up by the Social Workers for up to 3 months as needed.	

Appendix IV: Study findings and conclusions

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
Randomized Controlled Trials						
Altfeld[42] N treatment=360 N control=380	Physician	Follow-up visit within 30 days of hospital discharge	239/360 74.9% OR, 2.09 95% CI 1.51-2.89	206/360 57.4%	<.001	Chi-square analysis showed that IG patients were significantly more likely than usual care patients to have had a physician visit within 30 days of discharge. Chi-square analysis showed no difference between groups on 30 day rehospitalization rates. Multivariate logistic regression models that adjusted for covariates showed that IG patients were significantly more likely to have kept a physician appointment than those in usual care, but there were no significant differences between groups on 30 day rehospitalization rates.
	Hospitalization	Readmissions within 30 days	70/360 19.5% OR, 1.11 95% CI .76-1.62	66/360 18.3%	.69 NS	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
Balaban[45] N treatment=585 N control=925	Hospitalization	Readmission within 30 days All 60+	14.2% 10.1%	13.1% 13.5%	(adj.) NS <0.05	There was no difference in 30 day admission rates between intervention and control patients for the whole study population. When the intervention study population was divided into 2 age groups (less than 60, 60 and older), the older group experienced a significant decrease in 30 day hospital readmission. Rates of primary care follow-up at 7 days was significantly higher for the whole intervention study population, but there was no significant difference for the intervention and CGs for those 60+. Outpatient visits within 30 days were significantly higher for the intervention than CGs, both for the whole study population and those 60+. No difference in rates of ED visits
	Primary care provider	Visit within 7 days of discharge All 60+	27.9% 29.9%	22.6% 25.2%	(adj.) <0.05 NS	
	Outpatient visit	Visit within 30 days of discharge All 60+	83.3% 85.2%	78.5% 79.1%	(adj. <0.05 <0.05	
	ED	Visit within 30 days of discharge All 60+	13.5% 9.4%	11.6% 8.1%	(adj.) NS NS	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
						within 30 days for either the whole study population or those 60+.
Boult[33] N treatment=446 N control=404	Hospitalization	Mean hospital admissions/person/year	0.70 OR 1.01; 95%CI (0.83-1.23)	0.72	NS	Raw mean annual per capita use of health care services for the treatment and CGs are reported. Below that data, the adjusted odds ratios of service use and confidence intervals are reported. The only statistically significant difference found was a 30% odds of reduction in the use of home health care for the IG compared to the CG. Very few participants used nursing home care (n=14), so these results should be interpreted with caution.
	Hospitalization	Mean 30 day hospital readmissions/person/year	0.13 OR 0.79; 95%CI (0.53-1.16)	0.17	NS	
	Hospitalization	Mean hospital days/person/year	4.26 OR 1.00; 95%CI (0.77-1.30)	4.49	NS	
	Nursing home	Mean nursing home admissions/person/year	0.20 OR 0.92; 95%CI (0.60-1.40)	0.25	NS	
	Nursing home	Mean nursing home days/person/year	2.84 OR 0.84; 95%CI (0.48-1.47)	4.03	NS	
	ED	Mean number of visits/person/year	0.44 OR 1.04; 95%CI (0.81-1.34)	0.44	NS	
	Primary care	Mean primary care visits/person/year	9.89 OR 1.02; 95%CI (0.91-1.14)	9.88	NS	
	Specialist	Mean specialist visits/person/year	9.04 1.07; 95%CI (0.93-1.23)	8.49	NS	
	Home health care	Mean home health care episodes/perso	0.99 0.70; 95%CI (0.53-0.93)	1.30	SIG	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
		n/year				
Buurman[30] N treatment=337 N control=337	Hospitalization	Percent readmitted	106/316= 33.5%	88/303= 29.0%	.76	No effect of the intervention was seen on the time to the first unplanned hospital readmission by 6 months. Home care services were by the CG, and they are very extensive in the Netherlands. This may explain why there was no differences between those who received transitional care and those that did not. Systematic geriatric assessment followed by a transitional care program, might improve patient safety during the vulnerable period that occurs shortly after hospital discharge.
	Hospitalization	Time to the first unplanned hospital readmission within 6 months	HR, 1.21; 95% CI 0.91-1.60		.76	
	Nursing home	Percent discharged to a nursing home	51/316= 16.1%	41/303= 13.5%	Not reported	
	Nursing home	Time to discharge home from a nursing home	Median =63 days, IQR 27-138 days	Median = 38 days, IQR 16-76 days	.76	
Coleman[2] N treatment=379 N control=371	Hospitalization	30 day hospital readmissions	8.3% OR 0.59; 95% CI (0.35-1.00)	11.9%	.048	Intervention patients had lower hospital readmission rates than control participants at each time interval of 30, 90, and 180 days. The differences between groups were statistically significant at 30 days
	Hospitalization	90 day hospital readmissions	16.7% OR 0.64; 95% CI (0.42-0.99)	22.5%	.04	
	Hospitalization	180 day hospital readmissions	25.6% 30.7% OR 0.80; 95% CI		.28	

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			(0.54-1.19)			and at 90 days, but not 180 days. Intervention patients were significantly less likely to be hospitalized at 90 days and at 180 days for the same condition that precipitated hospitalization, but not at 30 days. Log-transformed analysis showed that intervention patients had significantly lower hospital costs at 90 days and 180 days, but not at 30 days.
	Hospitalization	30 day hospital readmissions for prior reason	2.8% OR 0.56; 95% CI (0.24-1.31)	4.6%	.18	
	Hospitalization	90 day hospital readmissions for prior reason	5.3% OR 0.50; 95% CI (0.26-0.96)	9.8%	.04	
	Hospitalization	180 day hospital readmissions for prior reason	8.6% OR 0.55; 95% CI (0.30-0.99)	13.9%	.046	
	Hospital costs	30 day mean	$784	$918	.06	
	Hospital costs	90 day mean	$1,519	$2,016	.02	
	Hospital costs	180 day mean	$2,058	$2,546	.049	
Dhalla[27] N treatment=963 N control=960	Hospitalization	30 day 90 day 6 month 1 year	18.9% 33.4% 45.5% 59.2%	21.3% 33.7% 46.4% 58.4%	.22 .91 .74 .76	There were no statistically significant differences in any of the outcomes (hospital readmission, ED visits, or nursing home admission) at any of the 4 time points. Given the per-patient costs of the intervention, it is highly unlikely that a virtual ward model of care would represent an efficient use of health care resources.
	ED visit	30 day 90 day 6 month 1 year	28.1% 46.1% 60.9% 71.8%	29.6% 46.0% 59.8% 70.6%	.49 >.99 .68 .60	
	Nursing home admission	30 day 90 day 6 month 1 year	0.6% 2.2% 3.1% 4.2%	0.8% 1.4% 2.8% 4.2%	.80 .34 .78 >.99	
Ekdahl[31] JN treatment=208	Hospitalization	Mean number of hospitalizations	Mean= 2.8 SD=3.0	Mean= 3.4 SD=3.3	.06	The mean number of hospitalizations during the 36 months follow-up

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
N control=174		in 36 months				period did not differ significantly between groups. No significant difference between groups for moving to a nursing home. The mean number of inpatient days was significantly lower were n the intervention group versus the control group without higher total health care costs between groups. However, the cost of physician visits were significantly higher for the intervention group. However, the cost of physician visits were significantly higher for the IG.
	Hospitalization	Mean number of inpatient days in 36 months	15.1 SD=18.4	21.0 SD=25.0	.01	
	Nursing home	Moved to a nursing home within 36 months	30/208 HR 1.36, 95% CI (0.83-2.24)	32/174	.23	
	Health care costs	Mean costs per patient of health and social care in 36 months	$71,905 SD=$85,560	$65,626 SD=$66,338	.43	
	Physician	Mean cost of physician visits in 36 months	$5,074 SD = $2,914	$3,272 SD = $2,576	.00	
	Home health care	Mean cost of hospital-based home health care in 36 months	$492 SD = $2,079	$643 (USD) SD = $3,103	.57	
Gagnon[28] N treatment=212 N control=215	Hospitalization	Mean number of hospitalizations	0.5 SD=0.8	0.4 SD=0.7	NS	There was a significantly higher mean number of ED visits in the treatment versus the CG.
	Hospitalization	Mean hospital length of stay	13.0 SD=20.7	11.9 SD=13.1	NS	
	ED	Mean number of admissions	1.2 SD=2.0	0.9 SD=1.2	.041	
Imhof[32] N treatment=231 N control=230	Hospitalization	Number of 3 month periods with hospitalization	47, 23%	68, 33%	.03	The number of 3-month period with hospitalization was significantly lower in the IG than in the CG. There were no

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						significant differences between the two groups in the use of other health care services provided by family physicians, community health nurses, physiotherapists, and occupational therapists during the 9 month intervention period (data not included).
Kirchberger[29] N treatment=161 N control=168	Hospitalization	Unplanned admission within 3 years	160	262		The study failed to find a significant beneficial effect of the intervention. Regression analysis showed no significant effect of the intervention on a measure combining unplanned readmissions or death.
	Hospitalization	Planned admission within 3 years	118	108		
	Hospitalization	No hospital visits within 3 years	55	44		
	Hospitalization or death	Within 3 years, Cox regression analysis	HR 0.89, 95% CI 0.67-1.19		.439	
Linden[35] N treatment=253 N control=259	Hospitalization	30 day readmission rate per person	0.233 (SD 0.539)	0.193 (SD 0.459)	.364	There were no statistically significant differences in either 30 day or 90 day hospital readmission incidence rates between intervention and usual care groups. There were no statistically significant differences in either 30
	Hospitalization	90 day readmission rate per person	0.514 (SD 0.894)	0.479 (SD 0.869)	.661	
	ED	30 day ED visit rate per person	0.174 (SD 0.473)	0.147 (SD 0.459)	.503	
	ED	90 day ED visit rate per person	0.360 (SD 0.735)	0.305 (SD 0.823)	.408	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
						day or 90 day ED incidence rates between intervention and usual care groups.
Naylor[36] N treatment=118 N control=121	Hospitalization	/patient/year	1.18	1.79	<.001	There were significantly fewer hospitalizations among the intervention versus CG. There were significantly fewer home care nurse visits for the IG versus the CG. Total adjusted acute and home care costs per patient were significantly lower in the IG versus the CG.
	Hospitalization	Mean days/patient/ year	5.0±7.3	8.0±12.3	<.071	
	Physician's office	Mean visits/patient/ year	0.8±1.5	0.8±1.6	.609	
	ED	Mean visits/patient/ year	0.1±0.4	0.3±1.2	.116	
	Home care	Mean nurse visits/year	1.1±4.9	6.3±13.2	<.001	
	Health care costs	Acute care and home care mean cost/patient/yea r after discharge (adjusted)	$7,636	$12,481	.002	
Naylor[41] N treatment=177 N control=186	Hospitalization	Number admitted within 24 weeks	49	107	<.001	The intervention resulted in significantly fewer hospital readmissions and significantly fewer days in hospital at 24 weeks. The effect of the intervention on reducing the time to first readmission for any reason was significant after adjusting for
	Hospitalization	Mean (SD) days spent in hospital witin 24 weeks	1.53±3.69	4.09±8.35	<.001	
	Hospitalization	Adjusted time to first hospital readmission	2.03 95% CI1.33-3.08		<.001	
	Physician	Mean office visits within 24 weeks	1.5±2.2	1.6±2.2	.59	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
	ED	Mean visits within 24 weeks	0.1±0.5	0.2±0.4	.21	various factors (self-reported health status, living arrangements, diagnosis of CHF)
	Home care	Mean visits from visiting nurses within 24 weeks	3.1±7.2	7.1±12.0	.05	At 24 weeks, the groups did not differ significantly in the mean number of physician or ED visits. The CG received significantly more home care nursing visits than the IG within 24 weeks.
Newcomer[34] N treatment=1,537 N control=1,542	Hospitalization	1 or more hospital admission at 12 months	21.9%	23.3%	>.05	Service use was higher for the CG versus the IG, but there were no statistically significant differences between groups for any of the outcomes.
	Hospitalization	Mean monthly days (SD) at 12 months	1.3 (4.0)	1.5 (6.8)	>.05	
	ED	% with a visit at 12 months	25.9%	26.0%	>.05	
	Nursing home	% with 1 or more admission at 12 months	11.9	12.6	>.05	
	Primary care physician	Mean monthly visits at 12 months	0.4	0.4	>.05	
Parry[39] N treatment=49 N control=49	Hospitalization	30 day rehospitalization	6.8%	16.7%	.15	Intervention patients had lower hospital readmission rates than control patients at each time interval, but the
	Hospitalization	90 day rehospitalizatio	9.3%	31.0%	.01	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
		n				differences were statistically significant between groups at 90 days only.
	Hospitalization	180 day rehospitalization	20.9%	38.1%	.08	
Shannon[43] N treatment=271 N control=434	Primary care physician	Increased use	OR 2.05, 95% CI 1.28-3.28		<.001	There was less utilization of costly medical services during the intervention period than the CG. Those who received the care advocate services were twice as likely as controls to visit their primary care physician, but 57% less likely than controls to have increased hospital admissions and 61% less likely to have increased hospital days than controls.
	Specialist	Increased use	OR 1.67, 95% CI 0.96-2.92		NS	
	Hospital admissions	Increased use	OR 0.43, 95% CI 0.22-0.84		<.01	
	Hospital days	Increased use	OR 0.39, 95% CI 0.17-0.86		<.05	
	ED	Increased use	OR 0.78, 95% CI 0.42-1.43		NS	
Wong et al.[26] N treatment=54 N control=54	ED	Visits within 8 weeks	1/54, 1.9%	7/54, 13.0%	0.027	The IG had a lower observed rate of hospital readmission compared to the CG, but the difference was not statistically significant. The ED visits were significantly lower in the IG at 8 weeks compared to the CG.
	Hospitalization	Readmission at 8 weeks	4/54, 7.4%	8/54, 14.8%	0.358	
Wong[24]	ED	Readmitted within 28 days	HV 30/196,15.3%	44/210, 21.0%	0.141 0.166	There was no significant difference for either

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
N treatment – home visit arm=196 N treatment – call arm=204 N control=210			Call 32/204, 15.7%			treatment arm and the CG for ED admission for either 28 or 84 days. The IGs had lower hospital readmission rates, but the only significant difference was lower rates of hospital readmission within 28 days for the home visit intervention arm versus the CG. There was no significant difference for either treatment arm and the CG for the mean days of readmission stay within either 28 or 84 days.
	ED	Readmitted within 84 days	HV 57/196,29.1% Call 60/204, 29.4%	71/210,33.8%	0.306 0.336	
	Hospitalization	Readmitted within 28 days	HV 21/196,10.7% Call 24/204, 11.8%	37/210,17.6%	0.047 0.093	
	Hospitalization	Readmitted within 84 days	HV 42/196,21.4% Call 42/204, 20.6%	54/210, 25.7%	0.310 0.217	
	Hospitalization	Mean (95% CI) days of readmission stay in 28 days	HV 4.7 (2.4, 7.0) Call 8.0 (3.4, 12.7)	6.4 (3.5, 9.4)	0.601 0.470	
	Hospitalization	Mean (95% CI) days of readmission stay in 84 days	HV 7.7 (5.0, 10.4) Call 9.1 (5.7, 12.5)	9.8 (6.6, 12.9)	0.733 0.917	
Yu[25] N treatment = 90 N control = 88	Hospitalization	Hospital readmission	adjusted hazard ratio 0.83, 95% CI 0.46-1.50		.533	The total days of hospitalization was much lower in the IG versus the CG. Median days at 9 months was significantly shorter for the treatment group versus the CG.
	Hospitalization	Total days	229	408		
	Hospitalization	Readmissions within 9 months	25/90, 28%	27/88, 31%		
	Hospitalization	Median days in hospital at 9 months	7	11	<.001	
Comparable Cohort/Case Control Studies						
Coleman[38] N treatment=158	Hospitalization	Complicated post hospital episode %	9.5 OR 0.74; 95% CI 0.38-1.46	14.9	.35	The IG was significantly less likely to be rehospitalized at 30, 90,

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
N control=1235	Hospitalization	30 day hospital readmissions %	8.9 13.8 OR 0.52; 95% CI 0.28-0.96		.04	and 180 days compared to the CG. The time to first hospitalization was significantly longer for the IG. As evidenced by the hospital readmission rates at 30, 90, and 180 days, there was a sustained intervention effect over time, well beyond the 24 days of contact with the transition coach. There was a significant reduction for a ED visit or observation unit visit at 90 days only.
	Hospitalization	90 day hospital readmissions %	13.5 22.9 OR 0.43; 95% CI 0.25-0.72		.002	
	Hospitalization	180 day hospital readmissions %	22.9 32.0 OR 0.57; 95% CI 0.36-0.92		.02	
	Hospitalization	Time to first rehospitalization, median days	225.5 217.0 OR .58; 95% CI 0.41-0.83		.003	
	ED	ED or observation unit visit within 30 days %	11.0 14.2 OR 0.76; 95% CI 0.44-1.30		.40	
	ED	ED or observation unit visit within 90 days %	18.3 25.7 OR 0.61; 95% CI 0.39-0.95		.03	
	ED	ED or observation unit visit within 180 days %	37.1 36.0 OR 1.16; 95% CI 0.78-1.72		.48	
	ED	Time to first ED or observation unit visit, median days	192.5 193.0 OR .88; 95% CI 0.67-1.17		.69	
Gardner[44] N treatment=321 N control=321	ED	Mean (SD) visits per 1000	439 (1,096)	495 (1,512)	.55	Mean 6 month readmissions were significantly lower for the IG than the CG. Mean ED visits and
	Hospitalization	Mean (SD) observation stays per 1000	87 (325)	140 (407)	.07	
	Hospitalization	Mean (SD) 6	651	931	.01	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
		month readmission per 1,000	(1,153)	(1,383)		mean observation stays were also lower in the IG compared to the CG, but these differences did not achieve statistical significance.
	Health care costs per person in 6 months post-discharge	Mean total costs (SD)	$14,729 ($21,937)	$18,779 ($25,407)	.03	
		Mean ED visits (SD)	$142 ($329)	$177 ($441)	.25	
		Mean Observation stays (SD)	$172 ($993)	$328 ($1,897)	.19	The IG had significantly lower mean total health care costs for 6 months post-discharge. The IG had significantly lower mean 6 month readmission costs.
		Mean Inpatient readmissions (SD)	$8,011 ($16,532)	$11,671 ($20,750)	.01	
		Mean Home health (SD)	$2,337 ($2,818)	$2,092 ($3,009)	.29	
		Mean Nursing home (SD)	$1,482 ($5,411)	$1,732 ($5,867)	.57	Mean gross savings of all costs for 6 months post-discharge is $4,050 for each intervention participant, or $675 per case per month.
		Mean Physician visits (SD)	$1,447 ($2,937)	$1,724 ($2,984)	.24	
						The average intervention cost for each beneficiary was a total of $298, resulting in a cost savings of $3,752 per participant over 6 months.
Hamar[37] N treatment= 560 N comparison= 3340	Hospitalization	All readmissions	Incidence rate ratio (IRR)= .78 95% CI 0.66-0.93 (22% fewer readmissions in IG)		.0060	Significantly lower rates of all readmissions and readmissions within 30 days for the treatment group relative to the comparison group. The treatment group had
	Hospitalization	Readmissions within 30 days	Incidence rate ratio (IRR)= .75 95% CI		.0107	

Study	Outcome	Outcome Measurement	IG Results	CG Results	P value	Conclusions
			0.61-0.94 (25% fewer readmissions in IG)			22% fewer overall readmissions and 25% fewer 30 day readmissions
	Hospitalization	Adjusted annualized readmission rate per 1000 patients	603.0	774.1		
	Hospitalization	Adjusted odds of readmission	OR 2.1; 95% CI, 1.5-2.9			Odds of having a readmission was 2.1 times higher in the treatment group versus the comparison group.
	Hospitalization	Adjusted odds of having a 30 day readmission	OR 1.8; 95% CI, 1.3-2.5			Adjusted odds of having a readmission was 1.8 times higher in the comparison group relative to the treatment group.
	Hospitalization	Adjusted annualized rate/1000 patients	603.0/1000	774.4/1000		
Stranges[40] 3 groups: 1) ITT 2) per protocol 3) as treated N treatment= 217 N comparison= 927	Hospitalization	30 day readmission rates	1) 120/572 2) 23/217 3) 23/217	1) 99/572 2) 99/572 3) 196/927	.133 <.001 <.001	There were significant reductions in the 30 day readmission rate for the per protocol and as treated groups compared to the comparison group.
	Hospitalization	Days until readmission	1) 12± 9 days 2) 12± 9 days 3) 13± 9 days	1) 14± 9 days 2) 18± 9 days 3) 18± 9 days	.146 .015 .001	There were significantly fewer days to readmission for the per protocol and as treated IGs vs. the comparison group.
	Hospitalization	30 day odds of readmission	1) OR .923, 95% CI .626-1.341 2) data not reported 3) OR 2.469, 95% CI 1.40-4.347		NS <.001	
	Hospitalization	Cost avoidance, as	$2,138/ interventi			Those who did not receive the intervention

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		treated group	on			had an increased odds of being readmitted within 30 days. Hospitalization cost avoidance was estimated to be $2,138 per intervention.