Evaluating transition towards tailored hospital care for elderly people

Franka C. Bakker
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Evaluating transition towards tailored hospital care for elderly people

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Evaluating transition towards tailored hospital care for elderly people

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General introduction

Partially based on:
FC Bakker, MGM Olde Rikkert.
Hospital care for frail elderly adults; from specialized geriatric units to hospital-wide interventions. In: O Theou, Rockwood K (ed.). Frailty in ageing: biological, clinical and social implications. Karger, [in progress]
Introduction

This thesis describes a research and development project of the National Care for the Elderly Program, initiated by the Dutch ministry of Health, Welfare and Sports. Goal of the whole program is to improve outcomes of care among elderly persons age 70 years and older in such way that care is adapted to their needs and preferences while the costs of care remain steady (or decrease). In this goal, it follows findings from several research reports and advices from national advisory boards. These include the Advisory Committee on Health research (RGO) and the Health Council of the Netherlands (GR) who both concluded that there is a lack of knowledge regarding the cause and consequences of complex problems among frail elderly, related possible prevention strategies, and adequate organization of (medical) care practices. This thesis focuses particularly on how to improve hospital care for frail elderly inpatients.

Background

Hospital care for elders

Much of the acute care provided in hospitals concerns care for elderly people. Patients age 65 years and older are responsible for 40 to 50% of all nursing days. Regarding the Netherlands in particular, in 2010, nationwide 35.6% of all hospital admissions and even 47.4% of the nursing days included patients age 65 years and older. When focusing on patients age 70 years and older—the age category targeted in this thesis—the nationwide percentages were 27.6% and 38.4% respectively. In addition, one third of the surgical procedures involved patients age 65 years and older.

An important and very common clinical condition among this patient group is frailty. As concisely defined by Clegg et al., frailty develops as a consequence of age-related decline in many physiological systems, which collectively result in vulnerability to sudden health status changes triggered by minor stressor events. Frailty can be seen as a reduced ability to maintain functional equilibrium; certain events or stressors—either physical, psychological, social or environmental—may cause a disruption of the equilibrium towards passing the threshold of independent functioning. Frailty may thus lead to disability under influence of a stressor, however great heterogeneity can be distinguished among individual trajectories. See Figure 1.

Prevalence of frailty

Numbers on prevalence of frailty among hospitalized patients are scarce and they are highly dependent on the population included, the used definition of frailty and the
General introduction

Assessment methods.\textsuperscript{15, 16} For example, among 594 patients age 65 years and older in an American hospital the prevalence of both frail and intermediately frail was 42\% among patients admitted for elective surgery.\textsuperscript{17} They used the Fried frailty criteria which include five physical measures (gait speed, muscle strength, fatigue, weight and exercise). Among 276 patients age 75 years and older in two Dutch hospitals the prevalence of frailty varied from 50\% of patients on a surgical department to 80\% on an internal medicine department to almost 100\% on the geriatrics department.\textsuperscript{18} They used the Groningen Frailty Indicator (GFI), and found that most frailty indicators represented the psychosocial scale, next to the mobility and health scale of the GFI.

Figure 1 Frail elderly patients: vulnerability for critical changes in functioning.

The dotted lines represent possible trajectories for elderly patients who return or do not return to homeostasis and baseline functioning after a hospital admission. Frail elderly patients may recover from hospital admission in their level of independence, either fully or partially, and this process may be either fast or slow. But patients may also show no recovery, even greater decline or death. Slowing down in recovery and an end stage with incomplete recovery is the classical frailty trajectory (A). (Adapted from Clegg et al.\textsuperscript{11})

Adverse events

Yet, as a consequence of reduced physiological reserves (or: failing homeostatic mechanisms) among frail elderly persons, they are vulnerable for adverse events such as delirium, falls, functional decline, disability, independency, hospitalization, increased care needs, institutionalization and death.\textsuperscript{11, 15, 19, 20} But not only their functional reserves and the acute illness or chronic disease for which they were admitted to hospital makes them vulnerable for adverse events. Hospital stay in itself
is also a risk factor for adverse events. General hospital care processes are often insufficiently adapted to the needs and characteristics of frail elderly patients and therefore may cause unintended injury resulting in prolonged hospital stay, disability, or death. These processes include poor management of surgical, medical non-drug and medication procedures as well as inadequate knowledge and education among nurses and physicians regarding care complexities, co-morbidity and frailty.

A substantial part of adverse events among frail elderly patients is thought to be preventable, especially the development of (new) geriatric syndromes such as mobility impairments, falls, incontinence, polypharmacy, malnutrition, delirium, depression and (other) psychological impairments. A low hospital-acquired delirium incidence is even said to be an indicator for quality of hospital care for elderly patients. However, as is the case with monitoring frailty, investigating the incidence and multifaceted causal pathways of adverse events in elderly patients is complex and numbers are therefore highly dependent on the used definition of (preventable) adverse events and assessment methods, e.g. incidence rates of adverse events ranging from 5.3% up to 60%.

**Hospital-associated disability**

Nevertheless, disability is often described as one of the most important (consequences of) adverse events of hospital admission among frail elderly inpatients, as it results in a poor prognosis for independent functioning, increased use of healthcare services and mortality. The quality of hospital care probably plays an important role both in success rate of recovery of functional loss that occurred (shortly) before admission due to the illness which lead to hospital admission and in preventing additional functional decline during hospitalization. These negative effects of hospitalization on functional performance were already described decades ago as the ‘hazards of hospitalization of the elderly’.

By definition, hospital-associated disability is the development of a new disability in activities in daily living (ADL) at hospital discharge that was not present before the onset of the acute illness. These include disabilities regarding the six most basic ADLs bathing, dressing, rising from bed or a chair, using the toilet, eating, and walking across a room. It is estimated that at least 30% of hospitalized patients age 70 years and older develop hospital-associated disability. Among frail elderly patients this is even worse as—due to the multi-factorial nature of frailty—a change in health status often leads to a cascade of negative events towards functional decline. This is based on the fact that elderly persons face age- or disease-related changes in many (interrelated) organ systems, which precede frailty or vulnerability for stressors.

For example, changes in the musculoskeletal system may cause reduced muscle strength, leading to immobility. Restricted mobility during hospital stay due to bed rest or all kinds of barriers for improving physical activity may further reduce muscle
strength, bone density and mobility, possibly leading to deconditioning, falls and fractures, and/or (increased) dependency. Changes in the integumentary system and digestive system may cause altered thirst and nutrition, leading to a risk of dehydration and malnutrition. A restricted hospital diet and physical and social barriers for eating/drinking in bed, possibly in relation to disease-associated dehydration, may increase this risk further. Fragile skin in combination with bed rest increases a risk for pressure sores and infections. Changes in the nervous system and brain may increase the risk for cognitive impairments, and in addition to changes in the sensory system may cause people to be confused when being in a strange and isolated environment. As such, numerous pathways related to inadequate hospital care for frail elderly are met in clinical practice\textsuperscript{25}, which are dependent on many different physiological mechanisms as well as on a lack of support within the hospital to timely administer preventive activities.

**Organization of care**

So, basically, a very important question for judging the quality of hospital care may be whether frail elderly patients developed new or more severe psychological or functional impairment, leading to (further) loss of independent functioning. Figure 2 shows that, overall, a few categories of hospital processes may be the main contributors to whether adequate care for hospitalized frail elderly patients is being provided. These include the engaging or restricting characteristics of the physical hospital environment, (lack of) knowledge of and attention to frailty among nurses and physicians, tailored patient-centered care, prolonged bed rest and the use of physical constraints in contrast to the encouragement of mobilization and performing ADL independently, frailty-adapted medication management and care procedures, and quality of discharge planning.\textsuperscript{12, 21}

It is assumed that hospital-acquired delirium, functional decline and frailty can be prevented, delayed or treated if appropriate interventions and care are provided adequately.\textsuperscript{14, 26} This includes a multidisciplinary approach for prevention, assessment and treatment, as well as education of hospital staff in providing appropriate care to patient groups with complex medical problems.\textsuperscript{23} The geriatric medicine specialty provides tailored care with performing a comprehensive geriatric assessment (CGA) as a basic principle. CGA is defined as a “multidimensional interdisciplinary diagnostic process focused on determining a frail elderly person’s medical, psychological and functional capability in order to develop a coordinated and integrated plan for treatment and long-term follow-up”.\textsuperscript{27, 28} It can be delivered either on geriatric hospital departments with specialized staff or by specialized geriatrics teams across various hospital departments. However, for future care demands a more hospital-wide, integrated and multidisciplinary focus on improving care for elderly inpatients is necessary.
Developments in hospital care and outcome measures

Yet, although demographic, economic and epidemiological changes have been foreseen for years and medical innovations strongly improved the treatment possibilities particularly for the elderly population, many developments in the healthcare delivery system which do not fit the needs of especially the growing group of frail elderly
patients with multiple chronic diseases have occurred. These developments include for example a reduction in length of stay, decentralization and concentration of care including increased specialization and high-tech hospital care, and applying quality measures and benchmarks developed for disease specific purposes. Hospital services need to innovate, but also need to take into account the evidence of frailty and frailty related interventions while doing so. For example, the shortening of hospital length of stay increases the importance of continuation of geriatric care after hospital discharge in order to ensure optimal rehabilitation towards the desired functional level (Figure 1). In addition, the focus on traditional outcomes such as complications and disability may need to shift to more individualized and patient-centered measures such as goal attainment in order to meet the needs and preferences of elderly people. Incorporation of a wellbeing and autonomy focus next to a primarily curing-mindset may be needed in hospital care for especially frail elderly people.

Outline of the thesis

Taking the relevance and magnitude of the challenge of adapting hospital care to (frail) elderly people into account, this thesis focuses particularly on how to optimize hospital-wide care for elderly patients both from a cure, care and wellbeing perspective. The National Care for the Elderly Program offered the opportunity to experiment in reorganizing care for elderly persons with complex needs by funding so-called transition experiments, which have the goal to improve care structurally and across all disciplines involved in providing care and welfare services. How this should be done exactly in case of Dutch hospital care for frail elderly patients, was not yet known or was not yet done at the start of the National Program. Hence, the main question in this thesis is:

> What is the feasibility and effectiveness of an integrated and multi-component hospital-wide care program – the CareWell in Hospital program – developed to maintain or improve autonomy, independence and quality of life among persons age 70 years and older?

Subsequently, we performed sub-studies in our quest of answering this problem:

- **Chapter 1** provides an oversight of the evidence for hospital-wide interventions for frail elderly patients, based on a systematic review.
- **Chapter 2** describes the results of a pilot study of the CareWell in Hospital program which was performed to determine the feasibility of the program and gathering of research data.
• **Chapter 3** describes the development and validation of the CareWell in Hospital questionnaire as an innovative measure of frail elderly inpatient experiences with individualized and integrated hospital care next to more traditional effect measures.

• **Chapter 4** describes the development and validation of the geriatric in-hospital nursing care questionnaire (GerINCQ) as a measure for monitoring and evaluating the organizational and educational effects of the CareWell in Hospital program on nurses’ geriatric practices, attitudes and perceptions.

• **Chapter 5** discusses the value of process evaluation and core process measures which are advised to be used in evaluation of complex multi-component geriatrics interventions.

• **Chapter 6** proposes a graphical approach to concisely summarize the results of process evaluations of complex multi-component interventions including a core set of process measures, based on a performed narrative review.

• **Chapter 7** evaluates the implementation and effects of the CareWell in Hospital program which was performed to determine influence of the program on safety, efficiency and quality of hospital care for elderly inpatients hospital-wide.

• **Chapter 8** describes the economic and data gathering implications regarding use of healthcare resources within three months after discharge among frail elderly patients; a critical evaluation of such commonly used and preferred outcomes.
References

12. Covinsky KE, Pierluissi E, Johnston CB. Hospitalization-associated disability: “She was probably able to ambulate, but I’m not sure”. JAMA 2011 October 26;306(16):1782-1793.


CHAPTER 1

Hospital-wide interventions for frail elderly inpatients

Published as:
FC Bakker, SHM Robben, MGM Olde Rikkert.
Abstract

Background: Although it is widely recognized that frail older persons need adaptation of healthcare services, it is unclear how hospital care in general can best be tailored to their frailty.

Objective: To systematically review the evidence for hospital-wide interventions for older patients.

Methods: Pubmed, Cochrane CENTRAL, Cinahl, and reference lists of included articles (1980-2009) were searched. Papers describing (1) randomized controlled trials, controlled clinical trials, controlled before-after studies or interrupted time series, (2) patients ≥65 years admitted to hospital, (3) hospital-wide organizational interventions, and (4) patient-related outcomes, quality of care, patient safety, resource use, or costs were included. Two reviewers extracted data and assessed risk of bias independently, according to Cochrane Effective Practice and Organization of Care Review Group guidelines.

Results: The authors included 20 articles out of 1175. Mean age of study populations ranged from 74.2 to 85.8 years. Interventions included multidisciplinary (consultative) teams, nursing care models, structural changes in physical environment and/or changes in site of service delivery. Small or no effects were found on patient-related outcomes such as functional performance, length of stay, discharge destination, resource use and costs compared with usual care. Methodological quality evaluation showed data incompleteness and contamination as main sources of bias.

Conclusions: No single best hospital-wide intervention could be identified using strict methodological criteria. However, several interventions had positive results, and may be used in hospital practice. Since strict methodological designs are not optimal for evaluating highly complex interventions and settings, the authors recommend studying hospital-wide interventions for older persons using adapted quality and research criteria.
Introduction

The quickly growing number of frail older surgical and non-surgical inpatients emphasizes the need to develop hospital-wide interventions to improve outcomes of hospital care. Hospital-wide interventions are system interventions, not restricted to medical specialties or departments, that are available for all older hospitalized patients. Comprehensive geriatric assessment (CGA) has been introduced and further developed to maintain or improve functioning in frail older patients, and has been proven to be effective when implemented ward-based (as opposed to inpatient geriatric consultation service). CGA is a multidimensional, interdisciplinary diagnostic instrument designed to determine the medical, psychosocial and functional capabilities and limitations of elderly patients in order to develop a coordinated and integrated plan for treatment and long-term follow-up. However, having only one geriatric ward cannot improve care for all frail hospitalized older patients, since persons older than 65 years currently form the largest proportion of all inpatients. In addition, despite the development of CGA, there is still a high risk of poor functional outcomes and dependency during or after hospitalization. Delirium and falls are examples of major and often preventable adverse events, which quickly increase with age.

Thus, enforced by healthcare reforms, interest in effective and efficient care models for older patients, next to existing geriatric specialized wards, is increasing. Therefore, the primary objective of this article is to systematically review the evidence for hospital-wide interventions for frail older patients.

Methods

Data Sources
We performed a search of PubMed, Cochrane CENTRAL, and Cinahl, from 1 January 1980 to 15 May 2009, including only articles written in English. For PubMed a comprehensive search strategy was developed (online Appendix A), which was adapted for the other databases (online Appendices B and C). Methodological search filters for Medline (for PubMed) and Cinahl were used as described by the Cochrane Effective Practice and Organization of Care Group (EPOC).(www.epoc.cochrane.org) The snowball method was used to manually identify relevant references from the reference lists of included articles.

Study Selection
We explicitly searched for interventions that were developed to be implementable on a hospital-wide basis and therefore available for all hospitalized older patients. We defined hospital-wide interventions as integrated practices throughout the hospital.
system of care delivery for older patients, which are not restricted to medical departments or specialties (e.g. geriatric departments as the only place providing special attention to older patients and therefore available only for the, clearly visible, frailest patients). The term ‘frailty’ was primarily used as a term to retrieve studies of interest, but not as an in- or exclusion criterion, since there is still much debate on its definition. Studies were considered for inclusion when they: 1) included patients 65 years or older and acutely admitted to hospital, 2) described an organizational intervention designed and piloted or implemented to improve hospital-wide quality, safety or effectiveness of care for (frail) inpatients ≥65 years, 3) reported outcomes related to either quality of care, patient safety, patient-related outcomes, resource use or costs, and 4) were a randomized controlled trial (RCT), controlled clinical trial (CCT), controlled before-after study (CBA) or interrupted time-series (ITT). Studies describing 1) medical specialty-, disease- or disability-specific interventions, 2) pre- or post-hospital interventions (e.g. improvement of transfers), 3) specialized hospitals (e.g. rehabilitation, long-term, intermediate care), or 4) single-component interventions (e.g. use of falls prevention protocol) were excluded. The first and fourth exclusion criteria were chosen as we are looking for interventions which serve, in concordance to CGA, all frail older patients with their complex and heterogeneous health problems.

Data Extraction & Quality Assessment
Two researchers (FB and SR) conducted the initial search by independently examining each title and available abstract. Retrieved full-text studies were independently reassessed (FB and SR). A third researcher (MOR) was consulted in case of disagreement. Data were collected based on the checklist of the Cochrane EPOC Review Group, and abstracted using a modified version of the EPOC data extraction form (online Appendix D). Data collected included details of the intervention, patients and providers, setting, and primary outcomes. Quality assessment was included by using the most recent 2009 EPOC form, which includes nine standard criteria to assess the risk of bias: randomization, allocation concealment, baseline comparability, incomplete outcome data, blinding of participants, providers or outcome assessors, selective outcome reporting, or other risks of bias. A consensus-based risk of bias table was constructed.

Data Synthesis & Analysis
Conducting a meta-analysis was not feasible. Results of included studies were therefore analyzed by making qualitative, descriptive summaries. We show results as presented by original studies. Additionally, effect sizes (Cohen’s d) were calculated (d of 0.20 judged as small, 0.50 as medium, and 0.80 as large), when standard deviations and means were presented in the original article (further details: online Appendix F).
Results

Included Studies
The search strategy identified 1175 citations of which 11 articles could be included for analysis. The snowball method yielded an additional 9 articles. Figure 1 details the results of the steps in the search strategy. The 20 included articles represent results of 17 studies (12 RCT’s and 5 CCT’s).

Study Characteristics
Characteristics of included studies are shown in Table 1. More detailed information is available in Appendix Table 1 (online). The mean age of the population varied from 74.2 to 85.8 years across studies. Whereas most studies used age to select a frail population or selected frail patients during the intervention, seven of the included studies used additional criteria to select frail inpatients. As for the location of the intervention, one study described an intervention starting in the Emergency Department, whereas the other studies describe interventions initiated at general medical wards. All but two studies set up multidisciplinary teams; these two studies only made structural changes in physical environment and/or site of service delivery. Four studies initiated, in addition to a multidisciplinary team, an intervention including modifications of the physical environment. In seven studies the main providers of the intervention were nurses. In one study the main providers of care were rehabilitation staff. In the other studies (geriatric) physicians were the responsible professionals and/or main providers of the intervention. Interventions (I) were compared to controlled usual care (C) as provided throughout the hospital, prior or next to the interventions.

Risk of bias
On average, we found two main sources of potential bias (Table 2). For 14 articles, it was unclear whether or not the incomplete outcome data had been addressed adequately (i.e. it was not specified whether missing outcome measures potentially biased the results as presented in the article). Contamination was inadequately addressed or not described in 19 articles.

Effectiveness of Interventions
Primary outcomes were functional performance, length of stay, mortality, discharge destination, readmission, complications, resource use and costs (Table 1; further details: online Appendix Table 2).
Table 1  Characteristics and results on primary outcomes in the 20 studies included

<table>
<thead>
<tr>
<th>STUDY</th>
<th>DESIGN</th>
<th>PATIENTS</th>
<th>INTERVENTION</th>
<th>CONTROL</th>
<th>PRIMARY OUTCOMES*</th>
<th>RESULTS†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campion27, 1983 general teaching hospital, USA</td>
<td>CCT, pilot study Median follow-up 10.5 months</td>
<td>All patients ≥75 years admitted to teaching medical wards I/C: 46/86</td>
<td>GCT (a/b/c/d/e/f/g/h/i) provided CGA, consultation and in-patient follow-up to all admitted patients, with the attending physician being responsible for implementation of written or verbally communicated recommendations.</td>
<td>Two similar wards, GCT not available</td>
<td>Discharge destination u</td>
<td>ns/NS</td>
</tr>
<tr>
<td>Collard19, 1985 2 community hospitals, USA</td>
<td>RCT Follow-up 6 months</td>
<td>All medical/surgical patients ≥65 years I/C: 218/477</td>
<td>10 bed Geriatric Special Care Unit in an existing space adopting a primary nursing model of care available for all randomly admitted patients.</td>
<td>Task-oriented model of care (c/k)</td>
<td>Complications ns/NS</td>
<td>ns/NS</td>
</tr>
<tr>
<td>Becker28 ǁ, 1987 VA Medical Center, USA</td>
<td>RCT No follow-up</td>
<td>All patients ≥75 years admitted to medical, psychiatric and surgical wards I/C: 92/89</td>
<td>GCT (a/b/c/l) placed specific prioritized list of recommendations in charts, discussed it directly with ward staff, and provided in-hospital follow-up for all admitted patients.</td>
<td>GCT placed only problem list in charts</td>
<td>Hospital-acquired complications NS</td>
<td>ns/NS</td>
</tr>
<tr>
<td>Saltz51 ǁ, 1988</td>
<td>Follow-up 6 months</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Discharge destination NS</td>
<td>ns/NS</td>
</tr>
<tr>
<td>McVey31 ǁ, 1989</td>
<td>No follow-up</td>
<td>I/C: 88/90</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Functional outcomes NS</td>
<td>ns/NS</td>
</tr>
<tr>
<td>Gayton24, 1987 teaching hospital, Canada</td>
<td>CCT Follow-up 6 months</td>
<td>All patients ≥70 years directly admitted to (4) general medical wards from ED I/C: 222/182</td>
<td>GCT (a/b/c/d/e) provided consultation, suggestions and in-hospital follow-up to randomly assigned patients after informal contacts with ward staff and weekly ward rounds.</td>
<td>Usual care</td>
<td>Functional outcomes u</td>
<td>u</td>
</tr>
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Note: ns/NS indicates not significant/NS.
### Table 1: Characteristics and results on primary outcomes in the 20 studies included

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Follow-up</th>
<th>PATIENTS</th>
<th>INTERVENTION</th>
<th>PRIMARY OUTCOMES</th>
<th>RESULTS</th>
<th>CONTROL</th>
</tr>
</thead>
</table>
| Campion, 1983 | CCT | 2 years | All patients ≥75 years with one of specified geriatric syndromes, admitted to the Department of Medicine on an emergency basis | GCT (a/b/d) provided consultation, recommendations to attending staff and in-hospital follow-up for all eligible patients. | Usual care | Functional outcomes:  
- change mental score (+)  
- change Barthel Index score (scale not specified)  
- LOS (ns)  
- Discharge destination (ns)  
- Resource use in-hospital (+)  
- Use of restraints (ns)  
- Costs (ns) |
| Becker, 1987 | No follow-up | 6 months | I/C: 218/477 | GCT placed in charts | Usual care | Functional outcomes:  
- Hospital-acquired complications (NS)  
- Resource use post-discharge (ns)  
- Prescribed oral medications (+)  
- number decrease |
| Saltz, 1988 | 6 months | I/C: 88/90 | Functional outcomes | Functional outcomes:  
- shift from functional to traditional medical and surgical wards (consult geriatrician possible) |
| Gayton, 2012 | CCT | Follow-up 12 months | All patients ≥75 years admitted to the Department of Medicine on an emergency basis, with Geriatric Status categories 3, 4, 5 | GCT (a/b/c/d/e/h/n) provided assessment, in-hospital follow-up and post-hospital follow-up for all patients through initial contact by physician-to-physician consultation, involvement of other members as required. | Usual care | Functional outcomes:  
- 3 months (ns)  
- 6 months (ns)  
- 12 months (+)  
- Discharge destination (ns)  
- Mortality (ns)  
- Rehospitalization (ns) |
| Hogan, 1987, Canada | RCT | Follow-up 12 months | All patients ≥75 years with one of specified geriatric syndromes, admitted to the Department of Medicine on an emergency basis | I/C: 57/56 | usual care | Functional outcomes:  
- change mental score (+)  
- change Barthel Index score (scale not specified)  
- LOS (ns)  
- Discharge destination (ns)  
- Resource use in-hospital (+)  
- Use of restraints (ns)  
- Costs (ns) |
| Fretwell, 1990, USA | RCT | Follow-up 6 months | All patients ≥75 years | GCT (a/b/c/d/h/m) provided assessment, recommendations in chart, in-hospital and post-discharge follow-up to all randomized patients, with a focus on functional assessment by nurses within routine admission evaluations, and the attending physician being the main responsible. | Usual care | Functional outcomes:  
- functional; ADL (ns)  
- mental; MMSE (ns)  
- emotional; SDS (+)  
- LOS (ns)  
- Costs (ns) |
| GCT | Follow-up 12 months | All patients ≥75 years admitted to the Department of Medicine on an emergency basis, with Geriatric Status categories 3, 4, 5 | I/C: 66/66 | GCT (a/b/c/d/e/h/n) provided assessment, in-hospital follow-up and post-hospital follow-up for all patients through initial contact by physician-to-physician consultation, involvement of other members as required. | Usual care | Functional outcomes:  
- 3 months (ns)  
- 6 months (ns)  
- 12 months (+)  
- Discharge destination (ns)  
- Mortality (ns)  
- Rehospitalization (ns) |
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<th>PRIMARY OUTCOMES</th>
<th>RESULTS</th>
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<tr>
<td>Inouye\textsuperscript{23}, 1993 teaching hospital, USA</td>
<td>CCT</td>
<td>All patients ( \geq 70 ) years admitted to one of 5 general medical units</td>
<td>Introducing the Yale Geriatric Care Program, a nursing-centered model of care at 2 acute medical units (1 nurse-only, 1 geriatric-nurse), where a care team (a/b) screened all patients for frailty, provided in-hospital follow-up for all frail patients, and educated all nurses.</td>
<td>Usual care, 3 medical units</td>
<td>Functional outcomes</td>
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<td>Thomas\textsuperscript{25}, 1993 community hospital, USA</td>
<td>RCT</td>
<td>All patients ( \geq 70 ) years</td>
<td>GCT (b/c/d/h/i/m/o) provided assessment, recommendations in charts with copies to attending physician's office, and in-hospital follow-up for all inpatients.</td>
<td>No recommendations, no subsequent visits</td>
<td>Functional outcomes</td>
<td>NS</td>
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<tr>
<td>Winograd\textsuperscript{13}, 1993 VA Medical Center, tertiary care teaching hospital, USA</td>
<td>RCT</td>
<td>All male patients ( \geq 65 ) years admitted to acute medical and surgical wards, and functionally impaired with one of proxy criteria for frailty</td>
<td>GCT (a/b/c/l/p) provided assessment and in-hospital follow-up for all inpatients screened as frail, placed recommendations in charts, discussed them with the primary care team, and provided in-service education when needed.</td>
<td>Usual care, not evaluated by GCT</td>
<td>Functional outcomes</td>
<td>NS</td>
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\textsuperscript{1} Functional outcomes: ADL, IADL, MMSE, PSMS, MMSE, LOS, IADL. \textsuperscript{2} Resource use post-discharge: community services, outpatient visits. \textsuperscript{3} Costs: Rehospitalization, Mortality, LOS, Discharge destination.
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<th>Results</th>
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<tr>
<td>Clark(^{14}), 1995&lt;br&gt; teaching hospital, USA</td>
<td>CCT&lt;br&gt;No follow-up</td>
<td>All patients (\geq 65) years, at risk of falls, mental status changes or associated diagnoses</td>
<td>Dayroom (hospital room with special features and activities) on a medical nursing unit, staffed by existing nurses, available for 4 selected patients at a time.</td>
<td>Usual care in hospital rooms&lt;br&gt;Functional outcomes&lt;br&gt;• ADL &lt;br&gt;• SPMSQ score &lt;br&gt;• LOS&lt;br&gt;Resource use in-hospital &lt;br&gt;+</td>
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<td>Landefeld(^{10}), 1995&lt;br&gt; teaching hospital, USA</td>
<td>RCT&lt;br&gt;Follow-up 3 months</td>
<td>All patients (\geq 70) years acutely admitted for general medical care</td>
<td>14 bed Acute Care for Elders unit, consisting of a specially designed environment, patient-centered care, discharge planning, and medical review, with the primary nurse being the key provider in providing care for all inpatients.</td>
<td>Usual care in another general medical ward&lt;br&gt;Functional outcomes &lt;br&gt;+</td>
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<td>Reuben(^{15}), 1995&lt;br&gt; HMO: 4 medical centers, USA</td>
<td>Multi-site RCT&lt;br&gt;Follow-up 12 months</td>
<td>All patients (\geq 65) years with (\geq 1) of 13 screening criteria</td>
<td>GCT (a/b/c) provided written recommendations to attending physician and primary care physician (with the geriatrician being able to order small therapies directly), in-hospital follow-up, and post-discharge follow-up to all eligible patients.</td>
<td>Usual care&lt;br&gt;Functional outcomes&lt;br&gt;• ADL&lt;br&gt;• Social activities&lt;br&gt;• Mental health&lt;br&gt;- 3 months&lt;br&gt;- 12 months&lt;br&gt;• Health perceptions&lt;br&gt;- 3 months&lt;br&gt;- 12 months&lt;br&gt;Mortality&lt;br&gt;ns</td>
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<td>Asplund(^{26}), 2000&lt;br&gt; university hospital, Sweden</td>
<td>RCT&lt;br&gt;Follow-up 3 months</td>
<td>All patients (\geq 70) years admitted acutely from ED to general medical wards</td>
<td>11 bed geriatrics-based ward, comprised of a care team (a/d/e/h/p) who provide assessment, early rehabilitation, and intense discharge planning for all unselected randomized patients, and an internist having main responsibility during the acute phase.</td>
<td>Usual care on 2 existing general medical wards, each 30 beds (c)&lt;br&gt;Functional outcomes&lt;br&gt;Rehospitalization&lt;br&gt;Costs&lt;br&gt;Resource use post-discharge&lt;br&gt;• Physician&lt;br&gt;• Nurse&lt;br&gt;• Physio-/occupational&lt;br&gt;ns&lt;br&gt;ns&lt;br&gt;ns&lt;br&gt;+</td>
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<td>Counsell21, 2000</td>
<td>RCT Follow-up 12 months</td>
<td>All patients ≥70 years admitted acutely to medicine or family practice I/C: 767/764</td>
<td>34 beds Acute Care for Elders unit, consisting of a specially designed environment, patient-centered care, early discharge planning and medical review, with nurses having a key role in providing care for all inpatients.</td>
<td>Usual care (GCT already available in hospital)</td>
<td>Functional outcomes</td>
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<td>Cohen16*, 2002</td>
<td>Multi-site RCT Follow-up 12 months</td>
<td>All frail patients ≥65 years admitted to medical or surgical wards I/C: 348/348</td>
<td>Geriatric Evaluation and Management including a team (a/b/c) who provided assessment, a care plan, and coordinated preventive and management services for all eligible patients.</td>
<td>Usual care</td>
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<td>Phibbs18*, 2006</td>
<td>RCT</td>
<td>All older patients (78.7 ± 6.4 years) presenting to the ED with ≥1 screening criteria I/C: 114/110</td>
<td>Aged Care Nurse in the Emergency Department assisted in care of eligible patients by early assessment, referral of patients and placing recommendations in the medical file.</td>
<td>Usual process (geriatric specialty present in hospital)</td>
<td>Resource use post-discharge Costs</td>
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<tr>
<td>Basic17, 2005</td>
<td>RCT No follow-up</td>
<td>All older patients (78.7 ± 6.4 years) presenting to the ED with ≥1 screening criteria I/C: 114/110</td>
<td>Aged Care Nurse in the Emergency Department assisted in care of eligible patients by early assessment, referral of patients and placing recommendations in the medical file.</td>
<td>Usual process (geriatric specialty present in hospital)</td>
<td>Hospital admission LGS</td>
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Abbreviations: VA = Veteran Affairs; HMO = Health Maintenance Organization; LOS = length of stay; ADL = Activities of Daily Living; MMSE = Mini-Mental State Examination; SDS=Self Rating Depression Scale; IADL= Instrumental Activities of Daily Living; PSMS = Physical Self-Maintenance Scale; SPMSQ = Short Portable Mental Status Questionnaire Score; (HR)QoL= (Health-Related) Quality of Life; CGA = Comprehensive Geriatric Assessment

*Outcomes are the primary outcomes as described in the article.
†Results: + = statistically significant in favor of the experimental group with p<.05; - = statistically significant in favor of the control group with p<.05; NS = not significant; ns = described as not significant, but no p-value given; u = unknown/no statistical analyses performed. More detailed information is presented in Appendix Table 2 (online).
‡I/C = Intervention Group/Control Group
§GCT = Geriatric Consultation Team; the disciplines composing the GCT are noted as: a = geriatrician, b = (geriatric) nurse (consultant/specialist/coordinator/practitioner/discharge planning), c = social worker, d = physical therapist, e = occupational therapist, f = speech therapist, g = recreational therapist, h = dietitian, i = geropsychiatrist, j = physician, k = medical director, l = fellow in geriatrics, m = (clinical) pharmacist, n = pastoral carer, o = home health nurse, p = internist/internal medicine house officer
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<td>Counsell, 2000</td>
<td>RCT</td>
<td>Follow-up 12 months</td>
<td>All patients ≥ 70 years admitted acutely to medicine or family practice</td>
<td>Usual care (GCT already available in hospital)</td>
<td>Functional outcomes</td>
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<tr>
<td>Cohen, 2002</td>
<td>Multi-site RCT</td>
<td>Follow-up 12 months</td>
<td>All frail patients ≥ 65 years admitted to medical or surgical wards</td>
<td>Usual care</td>
<td>Health-related QoL</td>
<td>ns, NS, NS, +, NS, NS</td>
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<tr>
<td>Phibbs, 2006</td>
<td>Resource use post-discharge</td>
<td>Costs</td>
<td>Geriatric Evaluation and Management including a team who provided assessment, a care plan, and coordinated preventive and management services for all eligible patients.</td>
<td>Usual process (geriatric specialty present in hospital)</td>
<td>Functional outcomes</td>
<td>+, -</td>
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<tr>
<td>Basic, 2005</td>
<td>RCT</td>
<td>No follow-up</td>
<td>All older patients (78.7 ± 6.4 years) presenting to the ED with ≥ 1 screening criteria</td>
<td>Usual process (geriatric specialty present in hospital)</td>
<td>Functional outcomes</td>
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Abbreviations: VA = Veteran Affairs; HMO = Health Maintenance Organization; LOS = length of stay; ADL = Activities of Daily Living; MMSE = Mini-Mental State Examination; SDS = Self Rating Depression Scale; IADL = Instrumental Activities of Daily Living; PSMS = Physical Self-Maintenance Scale; SPMSQ = Short Portable Mental Status Questionnaire Score; (HR)QoL = (Health-Related) Quality of Life; CGA = Comprehensive Geriatric Assessment

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‡ I/C = Intervention Group/Control Group
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¶ same study
Chapter 1

Functional outcomes

Fourteen studies presented results on functional patient outcomes. Of these, five studies (four Geriatric Consultation Teams (GCT)\(^1\), 13, 15, 22, one dayroom\(^1\)) showed significant effects for patients in the intervention group on mental health, emotional or cognitive status. Three studies (two GCT\(^1\), 16, one Acute Care for Elders unit\(^2\)) demonstrated significant improvements in physical outcomes.

<table>
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Note: + = yes; - = no; ? = unclear/not reported
*same study; †same study

Table 2 Summary assessment of potential sources of bias

Functional outcomes

Fourteen studies presented results on functional patient outcomes. Of these, five studies (four Geriatric Consultation Teams (GCT)\(^1\), 13, 15, 22, one dayroom\(^1\)) showed significant effects for patients in the intervention group on mental health, emotional or cognitive status. Three studies (two GCT\(^1\), 16, one Acute Care for Elders unit\(^2\)) demonstrated significant improvements in physical outcomes.
Mortality
Of five studies having mortality as one of the primary outcome measures, two (GCT\textsuperscript{12, 25}) revealed positive significant results on survival or mortality at 6 months follow-up.

Length of Stay
Of nine studies studying length of stay (LOS), one (primary nursing model of care\textsuperscript{19}) had a significant shorter LOS in one of the two experimental sites.

Discharge Destination
Eight studies focused on discharge destination. Of these, one (primary nursing model of care\textsuperscript{19}) showed a statistically significantly higher nursing homes admission rate and one (GCT\textsuperscript{18}) had a significant lower number of nursing home admissions at 12 months.

Resource Use
Two studies studied in-hospital resource use, of which one (GCT\textsuperscript{11}) showed a significant higher rate of referral to rehabilitation services. Six studies measured post-discharge resource use. Three (two GCT\textsuperscript{18, 11}, one geriatric-based ward\textsuperscript{26}) showed a significant lower average number of nursing home days per patients at 12 months, higher mean number of referrals to community services, or a higher number of outpatients visits per patients to a physical or occupational therapist up to three months follow-up.

Readmission
One\textsuperscript{25} of five studies (four GCT\textsuperscript{12, 13, 25-27}, one geriatric-based ward\textsuperscript{25}) presenting data on rehospitalization showed fewer readmissions per patient, at 6 months follow-up.

Complications
A primary nursing model of care and a GCT registering hospital-acquired complications showed no statistically significant results\textsuperscript{19, 28}

Economic Variables
Four studies evaluated costs of the intervention\textsuperscript{18, 19, 22, 26}. Two (primary nursing model of care\textsuperscript{19}, GCT\textsuperscript{18}) demonstrated lower costs.

Discussion
This systematic review assessing the effects of interventions to improve hospital-wide care for older inpatients showed that no single best evidence-based practice can be described, that improves quality of care, safety and effectiveness. Different forms of
geriatric consultation teams were partly effective in improving patient-related outcomes and process quality measures. Additionally, nursing models of care, wards admitting all older patients and environmental adaptations were found, with heterogeneous effects in different settings. The designs are methodologically not sufficiently strict and the studies too heterogeneously described to allow summary statistics or a Cochrane high-quality evidence rating.

The heterogeneity in the studies can be explained in several ways. First, hospitals differ from site to site in catchment area and associated demographic and sociocultural setting, referral practice, specialization, staff, and overall quality and safety of care. Consequently, care interventions highly differ, even if they are based on a similar model of care. In addition, positive effects across studies were found on different outcomes and positive outcomes only showed moderate or small effects (effect sizes ranged from .16 to .37). Ten studies introduced an intervention including GCT’s principles, of which four studies demonstrated no significant effects on their primary outcomes. Three showed small effects in mental status or mood. One of these ten showed positive effects on the Barthel score and survival, and one in survival and readmission rates. Four studies which introduced an intervention with nurses as main providers, found no or small effects, which they ascribed to limited availability of resources and thus limited intensity of the intervention. Of the two ACE unit studies which intended to be implemented hospital-wide eventually, one had positive results on functional outcomes.

However, although effects are small, positive results are definitely important in such a frail population. About 22 percent of persons older than 80 years who are admitted to a hospital die within one year after discharge, and the average time for partial or full recovery after hospitalization is 18 months. Therefore, each step forward is important in effectiveness of hospital care, such as stabilization of functional performance, and is an important positive result. Studies showing no significant improvement of overall functional status, mortality or readmissions, but which do show a tendency towards less functional decline, mortality, or readmission are therefore very valuable.

Comparison with published literature
As far as we know we are the first to review hospital-wide interventions, though there are articles describing intervention studies included here. Landefeld et al. summarized lessons to be learned from Geriatric Evaluation and Management (GEM) departments, ACE units, and the HELP set-up. Similarly, Palmisano-Mills identified the implementation of different versions of four models of integrated care for older patients (including...
HELP, ACE units, NICHE, and a Model of Transitional Care) in 24 hospitals in Connecticut. She found that few hospitals have implemented the original models, but that the majority successfully implemented key components of the care models as well as their own innovative protocols. However, the success of these implementation projects was never substantiated in an RCT.

This review only included RCT’s and CCT’s, which has led to exclusion of studies with lower methodological quality. However, as Table 2 shows, none of the included studies still is without serious risk of bias, only one study showing protection against contamination. This evokes the question whether these studies are methodologically flawed, but could have been performed better, or whether systematic review techniques applying strict methodological Cochrane criteria are less appropriate in selecting these complex evaluations of service delivery and organization of care.

As such, Harari and colleagues evaluated a hospital-wide intervention in which an Older Persons’ Assessment and Liaison (OPAL) team improved processes of care. Although the study design did not meet our inclusion criteria, results of this study are promising in terms of effectiveness and efficiency. The same conclusion may be drawn for the Older Adult Services Inpatient Strategies (OASIS) program, which aims for improvement of care for older patients throughout the hospital.

Additionally, we only found one study on the hospital-wide Hospital Elder Life Program (HELP), which could be included in our review. The others were excluded due to the study design or e.g. a focus on delirium in a specific patient group. Not including such studies based on design criteria is debatable, as such studies seem to support the evidence-based practice of implementation of HELP and subsequently prevent cognitive and functional decline. This also applies for the Nurses Improving Care for Health System Elders (NICHE) program, which has evolved into a national USA/Canadian geriatric nursing program. Our Cochrane review criteria yielded only two studies implementing a program based on NICHE.

A third intervention of which we could only include two articles is the Acute Care for Elders Unit (ACE), which is mentioned as the state-of-the-art care model to improve hospital-wide care for older adults. Also other studies support the evidence that development of ACE units can improve health and functioning of older persons, without increasing health care costs.

Limitations
It should be noted that our snowball method has favored older studies. However, recently a non RCT study of a proactive geriatrics consultation model was published, indicating that hospitals are still using similar models of care to improve care for frail older patients. The same accounts for the ACE unit, which was developed in the early 1990s, where efforts are still made to get (adapted versions of) this model of care disseminated throughout hospitals.
Future directions
The key message for hospital practice is that one should investigate what works best in a specific hospital, preferably by piloting an intervention that uses effective and innovative intervention components, and incorporates the barriers and facilitators of implementation as well (online Appendix Table 3). This stepwise procedure is proposed by the Medical Research Council’s framework for complex interventions. Dynamic and complex healthcare organizations, such as modern hospitals, require innovative interventions as well as innovative research designs that are flexible enough to allow changes to be made during the intervention (e.g. time series analyses, before-after studies). For innovative hospital reform interventions, this can be realized by transition management, which adapt interventions with regard to the facilitators and barriers met during the implementation process. For evaluation, apart from more flexible options than RCTs, we suggest to use quality indicators (QI’s) to monitor effects on the major health problems that are targeted. For example, the Assessing Care of Vulnerable Elders (ACOVE) indicators are objective and comprehensive measures, which are a useful starting point for developing site-specific QI’s. In addition, to be able to compare outcomes in older patients within and between studies, methods for incorporating key descriptors like cognitive and physical functioning to adjust for different case-mixes should be introduced into routine clinical practice. Another innovative and promising evaluation of health care reform by complex interventions is to follow the framework that has recently been proposed by Porter et al. This framework defines value measures as outcomes in evaluating healthcare practices. Porter provides a framework through which this value (or: performance) of an intervention can be identified, using multilevel patient-oriented outcomes related to their full costs. For both scientific and societal evaluation, it would be an important step forward to be able to continuously monitor the value of an intervention for a specific inpatient group like frail older patients.

Conclusion
The current aging of the population and developments in hospital care explicitly call for comprehensive interventions aimed to improve care for all frail older patients throughout the hospital. While implementing evidence-based practices is stimulated, only a few hospital-wide intervention RCT studies could be identified. It is urgently needed to study alternative approaches and to set adjusted scientific standards to gain firm evidence-based improvements in hospital-wide care for frail older patients.
Hospital-wide interventions for frail elderly inpatients

References


CHAPTER 2

Pilot of the CareWell in Hospital program

Published as:
No abstract
TO THE EDITOR: Many hospitals in the Netherlands have geriatric support but still a hospital-wide mind-set toward proactive integrated care, prevention of functional decline in older hospitalized adults and attention to subjective well-being in care,\cite{1,2} so the CareWell in Hospital (CWH) program was developed. CWH aims to improve functional status and attention to quality of life in hospital care by appointing trained volunteers, similar to the Hospital Elder Life Program (HELP)\cite{3}, which is innovative in Dutch hospital care, but before disseminating and sustaining HELP in the Netherlands, it was necessary to modify the program to make it feasible for Dutch hospitals.\cite{4-6}

The HELP program was introduced and adapted to the Netherlands as part of the CWH program. CWH comprises a first stage screening of patients aged 70 and older for risk of delirium, physical decline, falls and undernutrition by nurses, followed by second stage screening by a geriatric nurse, a CareWell plan including a medication review, inhosptial follow-up, and an updated CareWell plan at discharge. Additional components may include taking a medical history by proxy; having a geriatrician perform a comprehensive geriatric assessment; discussing a patient in a multidisciplinary meeting; and having trained volunteers performe therapeutic (cognitive) activities, nutritional assistance, or physical activities with patients (mobilization). The geriatric consultation team (GCT) also educates nurses and physicians.

A pilot study was conducted to determine the feasibility of the CWH program and gathering the research data. The pilot consisted of a pre- and post intervention evaluation performed from July 2010 to May 2011 at the University Centre for Chronic Diseases Dekkerswald, Nijmegen, the Netherlands. From October 1, 2010, CWH was implemented on two wards mainly with individuals with Chronic Pulmonary Obstructive Disease (COPD).

Feasibility was determined using a process evaluation\cite{7} on CHW program implementation and a (cost-)effectiveness evaluation. The degree of CWH program implementation was evaluated using data from records of meetings with program leaders; registered intervention elements provided to patients; and interviews conducted with patients, nurses, physicians and the CWH intervention team (GCT and trained volunteers). To determine feasibility of primary outcome measures for CWH effectiveness, data were gathered about delirium incidence (clinical judgment of a geriatrician), cognitive functioning (Mini-Mental State Examination) and physical functioning (Katz activities of daily living (ADLs)) at admission and discharge.

To determine the feasibility of a cost-effectiveness evaluation, data on length of stay (LOS) were collected from electronic medical files and data on use of healthcare services three months after discharge were collected using a written questionnaire. Healthcare services included hospital admission, visits of a general practitioner, home care, institutionalization, and day care. Because of privacy concerns, it was impossible to gather data from healthcare insurers or providers. To determine the validity of self-reported use of healthcare services, self-reported data on LOS were compared with LOS data from hospital administration.
The main findings from the process evaluation were that care professionals were more alert to patients’ geriatric needs, the GCT’s recommendations needed to be integrated and fine-tuned to usual care to improve daily practice, nurses felt that the introduction of a weekly multidisciplinary meeting was a major improvement, and volunteers needed to be trained and continuously coached in performing physically and cognitively stimulating activities. Integration of the activities that volunteers performed into the department was the most discussed subject during implementation meetings for several reasons; nurses and volunteers needed time to get to know each other and their roles and responsibilities, the characteristics of the patient population made it difficult to integrate volunteer activities in a patient’s day program, and volunteers needed time and intensive coaching to work independently.

Table 1 shows data collected from enrolled patients during the pre- and post intervention evaluations.

It was possible to analyze cost data for 19 patients in the control group and 11 patients in the intervention group. The mean cumulative costs per patient three months after discharge were €11,240 for controls and €9,133 for the intervention group. In cases in which patients were admitted to the hospital for stays shorter than 30 days, self-reported LOS data in the 3 months after discharge were comparable with data from the hospital administration system.

In conclusion, it is feasible to implement the CareWell in Hospital program, including trained volunteers, in Dutch hospital care. Multidisciplinary staff meetings and intensive coaching of volunteers were needed for successful implementation. Overall, the results of this pilot study were judged to be successful in that it enabled proactive integrated medical care to be instituted, and trained volunteers delivered a well-being component, which together stimulated a larger effect study (www.clinicaltrial.gov: NCT01273116).
Table 1 Characteristics of the Study Population, Implementation of Intervention Elements and Outcome Measures

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Pre Implementation N=28</th>
<th>Post Implementation N=28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at admission, mean ± SD</td>
<td>78.4 ± 6.3</td>
<td>79.0 ± 7.1</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>18 (64.3)</td>
<td>19 (67.9)</td>
</tr>
<tr>
<td>Cumulative Illness Rating Scale – Geriatrics (CIRS-G)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- mean score ± SD</td>
<td>12.3 ± 5.9</td>
<td>13.6 ± 3.4</td>
</tr>
<tr>
<td>- mean number of categories ± SD</td>
<td>5.5 ± 2.3</td>
<td>5.9 ± 1.8</td>
</tr>
<tr>
<td>First screening (frail), n (%)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22 (81.5)</td>
<td>22 (81.5)</td>
</tr>
<tr>
<td>• Second stage screening (frail)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>n.a.</td>
<td>20</td>
</tr>
<tr>
<td>• CareWell plan</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>• Medication review</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>• CGA by geriatrician</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>• Multidisciplinary meeting</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>• Volunteers indicated</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>• CareWell plan at discharge</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Delirious, n (%)</td>
<td>1 (3.8)</td>
<td>4 (14.8)</td>
</tr>
<tr>
<td>Mini-Mental State Examination score, mean ± SD (range 0-30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Admission</td>
<td>25.9 ± 3.6</td>
<td>24.6 ± 4.1</td>
</tr>
<tr>
<td>• Discharge</td>
<td>26.4 ± 2.8</td>
<td>25.7 ± 3.8</td>
</tr>
<tr>
<td>• Difference</td>
<td>0.7 ± 2.5</td>
<td>0.5 ± 2.4</td>
</tr>
<tr>
<td>Katz activity of daily living score, mean ± SD (range 0-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Admission</td>
<td>2.1 ± 2.0</td>
<td>2.1 ± 1.9</td>
</tr>
<tr>
<td>• Discharge</td>
<td>1.2 ± 1.7</td>
<td>1.6 ± 1.3</td>
</tr>
<tr>
<td>• Difference</td>
<td>0.75 ± 1.1</td>
<td>0.65 ± 1.4</td>
</tr>
<tr>
<td>Length of stay (days), mean ± SD</td>
<td>11.1 ± 8.2</td>
<td>10.0 ± 8.6</td>
</tr>
<tr>
<td>Readmission within 1 month in this hospital, n (%)</td>
<td>7 (25.0)</td>
<td>2 (7.1)</td>
</tr>
<tr>
<td>Died within three months after discharge, n (%)</td>
<td>5 (17.9)</td>
<td>4 (14.3)</td>
</tr>
</tbody>
</table>

There were no statistically significant differences between before and after implementation population characteristics and outcomes.

<sup>a</sup> Risk of functional decline, delirium, falls, or undernutrition as judged by nurses.

<sup>b</sup> A geriatric nurse from the intervention team judged patients as frail.

SD = standard deviation; N/A = not applicable.
References


CHAPTER 3

The CareWell in Hospital questionnaire for elderly inpatients

Published as:
FC Bakker, A Persoon, Y Schoon, MGM Olde Rikkert.
The CareWell in Hospital questionnaire: a measure of frail elderly inpatient experiences with individualized and integrated hospital care.
Abstract

Given our aging society with an increasing number of frail elderly patients, we must provide integrated care tailored to their complex needs regarding health and well-being. The aim of this study was to develop and validate a questionnaire designed to assess how frail hospitalized elderly patients experience several important aspects of individualized and integrated care. An eight-item questionnaire was developed using input from a panel representing the target group and administered to patients aged 70 years or older from surgical, medical and geriatric departments to measure data characteristics, internal consistency, test-retest reliability, construct validity and responsiveness. 470 questionnaires were returned, including 78 for test-retest reliability. Data were missing from 1.7% to 7.0% within the individual questions. The percentage of questions answered with “don’t know” ranged 3.8%-21.9%. Cronbach’s alpha for internal consistency was 0.70. Test-retest intra-class correlation was 0.75. Achievement of goals during the hospital stay was significantly correlated with the questionnaire score. Scores did not differ significantly between departments or between the before and after measurements related to an innovative intervention study in healthcare delivery. The CareWell in Hospital questionnaire has good content validity, internal consistency and test-retest reliability and warrants further research to explore responsiveness.
Introduction

Patient-reported quality of care is currently an important outcome measure. Ideally, quality of care is assessed by measuring patient’s experiences rather than patient satisfaction, as most patients are satisfied with the care they receive, even if the quality is poor.1 Within the study of the CareWell in Hospital (CWH) program2—which aims to improve quality of care for frail inpatients age ≥70 years—we aimed to assess experiences using a questionnaire to determine the quality of hospital care from the perspective of elderly inpatients. This questionnaire should specifically address whether individualized, integrated care is delivered, with an emphasis on autonomy and maintaining patient independence as well as integrating well-being into hospital care, all of which are aims of the CWH program. In this, it follows the perspective of integrated care as enabling the achievement of common goals and optimal care results from the patients’ view: care should be sensitive to the characteristics and needs of individual patients.3

In the Netherlands, a patient questionnaire to measure experiences with hospital care was carefully developed (partially based on CAHPS) and is used to obtain information for national benchmarking; the Consumer Quality Index (CQI).4 However, we considered this questionnaire containing 78 core questions as well as the time between discharge and measurement (often several months) too long for frail elderly patients as they have complex, multidisciplinary needs, and may have difficulty communicating their needs and reporting their experienced quality of care.

Here, we report the development and validation of a questionnaire that is based on the CQI and can be used to measure the quality of individualized and integrated hospital care as experienced by inpatients age ≥70 years.

Methods

Development

The predefined criteria for the questionnaire were: it should be brief, thereby reducing the burden placed on frail elderly persons, cover the aims of CWH, and measure experiences rather than satisfaction.

Ten categories were initially formulated to match CWH’s goals of autonomy, independence, well-being, individualized care, communication, coordination of care, continuity of care, patient safety, and competence of physicians and nurses. Items from the CQI questionnaire database5 were selected for each category. Ten members of a panel representing the elderly target group were invited to select the three most important questions in each category (first Delphi round). This panel is an important party within a regional network of care and wellbeing organizations and involved in discussing the various regional care and/or wellbeing projects when it concerns their
content and value for elderly persons. They represent elderly persons through their position in elderly- or informal care organizations or from personal experiences. During a second Delphi round, they determined whether the individual items of the concept questionnaire were clearly stated, comprehensible to frail elderly patients, represent quality of care, have appropriate answer categories, etc. The final questionnaire was edited to match the reading level of a twelve-year-old and approved by the panel in a face-to-face meeting. By this process, content validity was ensured.6

Data collection
The final questionnaire was mailed to both frail and non-frail medical and surgical inpatients who were included in the CWH before-after study (January 2011–July 2012) one week after their discharge, by a research assistant. See E-Appendix A for a description of the study and CWH program.

Patients in the CWH study who returned the questionnaire during the post-implementation measurement period were asked to participate in the test-retest reliability study until a pre-determined sample size of 75 was reached (March-November 2012). The target interval between returning the first and second questionnaire was 2-14 days.7

In addition, patients admitted to the geriatrics department—and therefore assumed to be frail—received the questionnaire upon discharge (February 2012–April 2013). The geriatrics department administered the questionnaire anonymously for evaluation and quality improvement purposes, as part of usual care. The secretary included the questionnaire in all patient files and a nurse provided the questionnaire to patients together with other important discharge documents. This questionnaire also included a question regarding goal attainment as this reflects whether what is important to the most frail elderly patients was accomplished.

Validation and analysis
Data were analyzed using the statistical software program SPSS version 18.0.

Data
Characteristics of (non-)responders, levels of missing data, and measurement range were assessed using descriptive statistics.

Reliability
Internal consistency was assessed by calculating Cronbach’s alpha for all available questionnaires with complete data. The answer categories were recoded to a 0-10 scale; 10 represents the highest quality of care. Test-retest reliability6 was assessed by calculating Cohen’s kappa for individual questions and intra-class correlation (ICC) for the questionnaire’s mean score.
Validity
The following hypotheses were tested in order to assess construct validity: lower scores for female patients and for patients who rate their health lower, and with higher education; higher scores for patients who had an elective admission and whose treatment goals were achieved (own reasoning). Finally, whether patients answered the questionnaire independently or with help should not affect scores (own reasoning). Spearman’s rho was calculated for non-parametric and ordinal data.

In addition, we performed a Kruskal-Wallis analysis to test the hypothesis that patients admitted to different departments have different scores. Second, we used the Mann-Whitney U test to detect differences before and after implementation of the CWH program.

For all these analyses, only questionnaires with complete data were included.

Results

Development
The selected answers within the categories communication and competence of nurses and physicians by the panel overlapped with questions from the other eight categories; thus, the final questionnaire contains eight core questions (see Table 1; E-Appendix B).

Data collection
Figure 1 shows a flowchart of the questionnaires.

Table 2 presents data of responders compared to non-responders who were included in the CWH study (N=293). Patients were aged ≥70 years and admitted ≥48 hours. Patients responded 14.8±11.3 days after discharge (N=265). Response rate was 75.8%. From 18 responders no baseline characteristics were available as only the questionnaire was collected from them to reach N=75 for test-retest purposes.

Patients in the geriatrics department responded in 10.5±15.0 days (N=111). Mean length of stay was 9.0±7.2 days (N=116). Data regarding other baseline characteristics and response rate were unavailable due to privacy concerns.

Data characteristics
Table 3 summarizes data of all 470 questionnaires. Response rates to the answer options ranged 3.8%-66.8%. Missing data among the questions ranged from 1.7% within question 8 to 7.0% within question 4. Upon combining the answer categories “I don’t know” and “missing”, 7/8 questions had >10% missing data; the questions 2-3 had the highest percentage of missing data due to the “I don’t know” answer option. The reasons stated by the respondents for why they could not answer these questions
included: cognitive disabilities, the perception that, because there was only one option (e.g., in case of emergency admissions), the question did not apply to them, and/or that the patients preferred not to co-decide because they felt that the physician knows best and can decide what is best.

Table 1 The eight core questions of the CareWell in Hospital questionnaire (see E-Appendix B for the entire questionnaire, including the answer categories)

| Question |  
| --- | --- |
| 1 | Were you informed sufficiently by your doctor regarding the various options for treating your health problems? |
| 2 | Were you able to indicate which treatment and/or care you preferred? |
| 3 | During your hospital stay, could you co-decide what was important to your care? |
| 4 | During your hospital stay, were you supported in keeping busy and finding social contacts and activities? |
| 5 | Did you know to whom you can go to within the hospital with questions, problems or complaints? |
| 6 | Before discharge, did you talk with a member of the hospital staff regarding the care you would need after discharge? |
| 7 | Did a member of the hospital staff inform the key people and/or care providers of your discharge from the hospital? |
| 8 | During your hospital stay, did you experience one or more of the following events? |
|     | ▪ Did you fall? |
|     | ▪ Did you become confused? |
|     | ▪ Did you develop pressure ulcers? |
|     | ▪ Did medication errors occur? |
|     | ▪ Did you develop a urinary tract infection? |
|     | ▪ Did you develop a wound infection? |
|     | ▪ Did you experience complications with your surgery and/or treatment? |

NOTE: The questionnaire for the geriatrics department included one additional question: “Within a few days of your hospital admission, a doctor discussed the goal of the admission with you. Did you achieve your goal(s) satisfactorily?” (no, not at all; yes, partially; yes, completely; don’t know; doctor did not discuss my goals)
Reliability

Of the 470 questionnaires, 222 (47.2%) had complete data and were used to analyze internal consistency. Cronbach’s alpha for the eight-item questionnaire was 0.70 (good internal consistency).

Seventy-eight questionnaires were available to measure test-retest reliability. The interval between test-retest was 8.7±4.8 days; 94.7% was returned within the targeted 14 days. 38 patients had complete data for both measurements: ICC on the mean score of the questionnaire was 0.75 (95% CI: 0.56-0.86), which indicates good test-retest reliability (Table 3). Including patients with incomplete data (1-2 missing items) yielded an ICC >0.70. Among the individual questions, Cohen’s κ ranged 0.28-0.82.
Table 2  Characteristics of the responding (N=293) and non-responding (N=88) patients who were included in the CareWell in Hospital (CWH) before-after study

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Responders</th>
<th>Non-responders</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, years ± SD</strong></td>
<td>275</td>
<td>88</td>
<td>0.701</td>
</tr>
<tr>
<td>Gender, male (%)</td>
<td>275</td>
<td>88</td>
<td>0.696</td>
</tr>
<tr>
<td>CIRS-G, score ± SD</td>
<td>274</td>
<td>88</td>
<td>0.071</td>
</tr>
<tr>
<td>MMSE admission, score ± SD</td>
<td>264</td>
<td>82</td>
<td>0.001</td>
</tr>
<tr>
<td>MMSE discharge, score ± SD</td>
<td>230</td>
<td>66</td>
<td>0.026</td>
</tr>
<tr>
<td>Length of stay, days ± SD</td>
<td>275</td>
<td>88</td>
<td>0.322</td>
</tr>
<tr>
<td>Department, surgical (%)</td>
<td>275</td>
<td>88</td>
<td>0.759</td>
</tr>
<tr>
<td>Admission type, n (%)</td>
<td></td>
<td></td>
<td>0.343</td>
</tr>
<tr>
<td>- Emergency</td>
<td>82 (29.8%)</td>
<td>22 (25.0%)</td>
<td></td>
</tr>
<tr>
<td>- Elective</td>
<td>138 (50.2%)</td>
<td>52 (59.1%)</td>
<td></td>
</tr>
<tr>
<td>- From other hospital or other department</td>
<td>55 (20.0%)</td>
<td>14 (15.9%)</td>
<td></td>
</tr>
<tr>
<td>Marital status, alone (%)</td>
<td>273</td>
<td>84</td>
<td>0.128</td>
</tr>
<tr>
<td>Discharge destination, n (%)</td>
<td>275</td>
<td>88</td>
<td>0.000</td>
</tr>
<tr>
<td>- Home</td>
<td>197 (71.6%)</td>
<td>54 (61.4%)</td>
<td></td>
</tr>
<tr>
<td>- Other hospital</td>
<td>69 (25.1%)</td>
<td>20 (22.7%)</td>
<td></td>
</tr>
<tr>
<td>- Care facility</td>
<td>9 (3.3%)</td>
<td>14 (15.9%)</td>
<td></td>
</tr>
<tr>
<td>Readmission, n (%)</td>
<td>275</td>
<td>88</td>
<td>0.146</td>
</tr>
<tr>
<td>Readmission &lt;1 month, n (%)</td>
<td>275</td>
<td>88</td>
<td>0.144</td>
</tr>
<tr>
<td>Death &lt;3 months following discharge, n (%)</td>
<td>274</td>
<td>86</td>
<td>0.233</td>
</tr>
<tr>
<td>Received CWH intervention</td>
<td>149</td>
<td>33</td>
<td>0.064</td>
</tr>
</tbody>
</table>

* NOTE: Data on baseline characteristics from 18 patients in the post-CWH measurement period are missing, as from those patients only the CareWell in Hospital questionnaires were gathered in order to reach n=75 for test-retest purposes.

CIRS-G = Cumulative Illness Rating Scale – Geriatrics, ranging from 0-56 (with a higher score indicating more co-morbidity). MMSE = Mini-Mental State Examination, ranging from 0-30 (with 30 representing the best score). Length of stay is defined as the time between admission to a CWH study department and discharge from a CWH study department.
Table 3  Data quality and range and test-retest reliability of all questionnaires received

<table>
<thead>
<tr>
<th>Question</th>
<th>data (n=470)</th>
<th>test-retest (n=78)</th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>κ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sufficiently informed regarding treatment options</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Not at all</td>
<td>23</td>
<td>4.9</td>
<td>65</td>
<td>0.278</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sometimes</td>
<td>90</td>
<td>19.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Often</td>
<td>115</td>
<td>24.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Every time</td>
<td>191</td>
<td>40.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Don’t know</td>
<td>29</td>
<td>6.2</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>- Missing</td>
<td>21</td>
<td>4.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment and care preferences discussed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>59</td>
<td>0.415</td>
</tr>
<tr>
<td>- Not at all</td>
<td>89</td>
<td>18.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sometimes</td>
<td>78</td>
<td>16.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Often</td>
<td>61</td>
<td>13.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Every time</td>
<td>111</td>
<td>23.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Don’t know</td>
<td>103</td>
<td>21.9</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Missing</td>
<td>28</td>
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<td>- Often</td>
<td>67</td>
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<td>Supported in finding (social) activities</td>
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<td>73</td>
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<td>7.0</td>
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<td>Knows relevant person for questions, problems, complaints</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>77</td>
<td>0.652</td>
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<tr>
<td>- Don’t know</td>
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<td>14.3</td>
<td></td>
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<td>17</td>
<td>3.6</td>
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<td>Discussed post-discharge care needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75</td>
<td>0.574</td>
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<tr>
<td>- Yes, sufficient</td>
<td>311</td>
<td>66.2</td>
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<td>- Yes, but insufficient</td>
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<td>20.3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- I don’t know/I don’t remember</td>
<td>18</td>
<td>3.8</td>
<td></td>
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<tr>
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### Table 3 Continued

<table>
<thead>
<tr>
<th>data (n=470)</th>
<th>test-retest (n=78)</th>
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<tr>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Hospital informed other important people/providers of discharge</td>
<td>69</td>
</tr>
<tr>
<td>- No</td>
<td>45</td>
</tr>
<tr>
<td>- Some were informed</td>
<td>54</td>
</tr>
<tr>
<td>- Yes</td>
<td>314</td>
</tr>
<tr>
<td>- Don’t know</td>
<td>38</td>
</tr>
<tr>
<td>- Missing</td>
<td>19</td>
</tr>
<tr>
<td>Adverse events during hospital admission</td>
<td>D.K.</td>
</tr>
<tr>
<td>- Fall; Confusion; Pressure ulcer; Medication error; Bladder infection; Wound infection; Complication of surgery/treatment</td>
<td>Max</td>
</tr>
<tr>
<td>sum mean n ICC</td>
<td>9.1%</td>
</tr>
<tr>
<td>Mean score on the total questionnaire, complete cases (n=222)</td>
<td>51.9</td>
</tr>
<tr>
<td>± ±</td>
<td>18.3</td>
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</tbody>
</table>

NOTE: D.K. = don’t know; MIS = missing. For adverse events, the minimum amount of missing data was 1.7%. Sum scores range from 0 to 80. Mean scores range from 0 to 10. $k =$ Cohen’s kappa.

**Validity**

The mean questionnaire score was significantly correlated with goals achieved while hospitalized (Table 4).

Mean scores did not differ significantly between departments (geriatrics: 6.8±2.2, N=88; cardio-thoracic surgery and lung diseases: 6.5±2.4, N=54; internal medicine: 6.3±2.5, N=30; general surgery: 6.0±2.2, N=50; p=0.234).

In addition, mean scores did not differ significantly before (6.5±2.2, N=53) and after (6.1±2.4, N=67) implementation of the CWH study, p=0.320.
### Table 4

Construct validity of the CareWell in Hospital questionnaire based on all questionnaires with complete data on both the variable and the questionnaire score.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>n*</th>
<th>Score ± SD</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>114</td>
<td>6.3 ± 2.3</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>108</td>
<td>6.7 ± 2.3</td>
<td></td>
</tr>
<tr>
<td>Health status</td>
<td>Excellent</td>
<td>1</td>
<td>-</td>
<td>0.071</td>
</tr>
<tr>
<td></td>
<td>Very good</td>
<td>5</td>
<td>7.9 ± 2.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>52</td>
<td>6.7 ± 2.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fair</td>
<td>120</td>
<td>6.5 ± 2.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>28</td>
<td>6.2 ± 2.1</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>&lt;6 grades primary school</td>
<td>4</td>
<td>4.9 ± 1.2</td>
<td>0.068</td>
</tr>
<tr>
<td></td>
<td>Primary school</td>
<td>19</td>
<td>6.4 ± 2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher than primary school</td>
<td>6</td>
<td>7.6 ± 1.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical training</td>
<td>27</td>
<td>6.0 ± 2.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary vocational training</td>
<td>41</td>
<td>6.1 ± 2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre-university education</td>
<td>2</td>
<td>7.2 ± 4.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University/higher education</td>
<td>20</td>
<td>6.8 ± 2.2</td>
<td></td>
</tr>
<tr>
<td>Admission type</td>
<td>Emergency</td>
<td>31</td>
<td>6.5 ± 2.6</td>
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<tr>
<td></td>
<td>Elective</td>
<td>61</td>
<td>6.6 ± 2.0</td>
<td></td>
</tr>
<tr>
<td>Goal of admission</td>
<td>Yes</td>
<td>33</td>
<td>7.6 ± 1.7</td>
<td>0.319**</td>
</tr>
<tr>
<td>achieved</td>
<td>Partially</td>
<td>24</td>
<td>6.6 ± 2.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>6</td>
<td>4.7 ± 2.8</td>
<td></td>
</tr>
<tr>
<td>Respondent</td>
<td>Patient only</td>
<td>117</td>
<td>6.7 ± 2.2</td>
<td>0.063</td>
</tr>
<tr>
<td></td>
<td>Patient with help</td>
<td>59</td>
<td>5.9 ± 2.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other person</td>
<td>41</td>
<td>6.7 ± 2.4</td>
<td></td>
</tr>
</tbody>
</table>

Mean scores range from 0 to 10. ** Correlation (Spearman’s rho) is significant at the 0.01 level (1-tailed for goal achieved).

* NOTE: the ‘n’ differs per analysis. Education level was not known for every patient; this variable was extracted from a different questionnaire. Admission type includes only emergency admission and elective admission; patients could also be transferred from another department or hospital, but was not included as a category as this might include emergency as well as elective admissions. Goal of admission was only available for patients from the geriatrics department, whereas educational level and admission type were not available for patients from the geriatrics department.
Discussion

The CareWell in Hospital patient questionnaire is a brief 8-item questionnaire to assess the experiences of elderly patients regarding integrated hospital care. It showed good internal consistency and test-retest reliability, and low responsiveness. Below, we discuss some issues related to the pre-set criteria of the questionnaire.

First, a panel representing the elderly target population was used to develop the questionnaire in order to ensure content validity, which was confirmed by good internal consistency. Yet, with respect to individualized, integrated care for frail elderly patients, we recommend including a question regarding the involvement of informal caregivers during the hospital stay, as they are important partners in healthcare.10

Second, the questionnaire was kept short because it should not be a burden and feasible to frail patients. Nonetheless, some of the questions had a high non-response rate, and many patients answered "I don’t know", particularly to the questions 2-3. It does not necessarily mean that these questions are poor in quality; it could also indicate that offering individualized care is not yet embedded in the culture of elderly patients and care professionals, such that patients consider such questions to be irrelevant.11, 12 Nevertheless, we suggest to further explore the feasibility of the questionnaire and potential additional methods for the most frail elderly13, who might have been excluded from the CWH study sample at this point (Table 2).

Third, the questionnaire measures experiences rather than satisfaction. Patient satisfaction scores are generally tightly correlated with the age, gender, education level, health status and the person completing the questionnaire.8 In our study, the correlation did not reach statistical significance. Nevertheless, the achievement of pre-set goals was correlated significantly with mean CWH scores (Table 4). These findings may indicate that individualized care experiences can indeed be assessed better using this questionnaire. Test-retest reliability also supports validity, as we expected—and indeed saw—higher reliability among the more objective questions (e.g., question 8). The most valuing question is question one, which also had the lowest reliability; the word “sufficiently” should perhaps be removed in the next version in order to increase its reliability and objectivity.

Finally, scores did not differ between before and after implementation of the CWH program, which suggests either that the questionnaire is unable to detect change or that the program was not sufficiently effective to invoke change yet. The latter option seems plausible, as changes in the provision of individualized care were ongoing. In addition, the items on which favorable differences can be seen for CWH are in fact the items which could be most directly influenced by the CWH interventionists, e.g. question 4, 6 and 7 (see E-Appendix C). Lastly, we performed an extra analysis concerning the discriminating property of the questionnaire in a subgroup of frail elderly patients; we do see a significant difference in scores between the frail patients...
on the geriatrics department and the frail patients who received the CWH intervention: 6.8 (N=88) versus 4.8 (N=13) for complete data respectively, $p=0.013$; and 6.8 (N=155) versus 5.7 (N=37) for incomplete data (2 items missing), $p=0.017$ (Mann-Whitney $U$ test). This may indicate that the questionnaire can measure differences in quality of care for specifically the frail elderly patients between departments. However, these issues – including validity and reliability characteristics per specific patient subgroup – warrant further research using a larger sample.

Conclusions
In conclusion, the CareWell in Hospital patient questionnaire is a feasible and reliable tool for assessing experiences of frail elderly inpatients in the provision of individualized, integrated care. To improve the questionnaire, we recommend to add a question regarding the participation of informal caregivers during the hospital stay, investigate the response rate to questions regarding participation and shared decision-making, and study responsiveness issues further.
References


CHAPTER 4

The Geriatric In-hospital Nursing Care Questionnaire (GerINCO)

In press:
A Persoon, FC Bakker, H van der Wal-Huisman, MGM Olde Rikkert.
Development and validation of the Geriatric In-hospital Nursing Care Questionnaire (GerINCO). J Am Geriatr Soc
Abstract

Background and objective: Current special programs are designed to improve the quality and safety of care for elderly people in medical and surgical departments. Although the positive influence of nursing practice on geriatric patient safety is well-recognized, an instrument for measuring in an integrated way the geriatric practices of hospital nurses and their attitudes towards and perceptions about geriatric care is currently not available.

Design: Questionnaire development.

Setting and participants: Thirteen experienced geriatric nurses and three geriatricians from 12 hospitals evaluated an initial version of the questionnaire. The final questionnaire was validated by 271 nurses from 11 geriatric, medical, and surgical departments in six hospitals.

Methods: Items from two published instruments were extracted for use in the questionnaire. Content validity was confirmed using the Delphi technique with an expert panel. Internal consistency was measured by calculating Cronbach’s alpha; intra-rater reliability was measured by test-retest correlations and intra-class coefficient (ICC); differences between hospital departments were analyzed by ANOVA. Sensitivity for detecting before and after changes with implementation of a geriatric care program was determined using the Student’s t-test.

Results: Consensus was reached after three Delphi rounds. The GerINCQ comprises 5 subscales and 67 items, had good content validity (each item CVI>0.9) and showed good internal consistency (Cronbach’s alpha = 0.86). The intra-rater reliability revealed high test-retest results (ICC=0.87). The questionnaire detected significant differences between nurses in three types of hospital departments (medical, surgical and geriatric (p<0.01)). The GerINCQ was sensitive to changes following an educational program (p<0.01) and showed a high effect size (0.5).

Conclusions: The GerINCQ is a reliable and valid tool and sensitive to change over time. The GerINCQ is clinically relevant, as it provides a quantitative measure of hospital nurses’ geriatric practices, attitudes, and perceptions. Moreover, the GerINCQ is suitable for monitoring progress after implementing geriatric improvement programs.
Introduction

As the average age of hospitalized patients continues to rise, more nurses and doctors are confronted with the baseline vulnerabilities of elderly patients, such as co-morbidity, medication use, and functional decline. Awareness has increased that the outcome of a hospitalization does not depend solely on the condition of the elderly, however, but also on the quality of specific geriatric programs. Delivering high-quality geriatric care in hospitals requires programs such as Senior-Friendly Hospitals and Nurses Improving Care for Healthsystem Elders/NICHE. Receiving high-quality care can prevent the onset of geriatric syndromes, including impaired mobility, falling, delirium, incontinence, and polypharmacy. Factors that can help improve geriatric care include the hospital’s physical environment, the hospital staff’s knowledge of—and attention to—patient frailty, personalized multidisciplinary tailored care, quality of discharge planning, and the adaptation of medication management and care procedures to meet the needs of frail elderly patients. Having a positive attitude, a strong working knowledge and competences with respect to geriatric patients is essential for improving the quality of care for elderly patients, as nurses are the key players in providing direct patient care and preventing adverse events.

This study focuses on the geriatric practices, attitude and perception of hospital nurses and is an important first step in optimizing geriatric care. In a Dutch university hospital (university medical center A), we developed a comprehensive geriatric program for our medical and surgical departments, the CareWell in Hospital program (CWH; see www.clinicaltrials.gov: NCT01273116) which was evaluated as well. One element of the CWH program is to focus on nurses’ awareness of heterogeneity among elderly people with respect to their health goals, and nurses’ knowledge of geriatric problems and adverse events. With respect to nurses from medical and surgical departments, the CWH includes geriatric education, consultation facilities by a geriatric team, the use of screening instruments, administrative support, and modifications in nursing care practices. Monitoring and evaluating the CWH program’s organizational and educational effects on nurses’ geriatric practices requires a single integrated instrument that can specifically measure the geriatric practices of hospital nurses, as well as their attitudes towards and perceptions of caring for elderly people. Therefore, the aim of this study was to develop and validate a reliable self-administered nursing questionnaire that can be used to measure these parameters in hospital nurses as a tool for facilitating the implementation of geriatric health care improvement programs.
Methods

Development and content validity
Based on a review of the literature, two investigators (FB and AP) developed an initial questionnaire using selected subscales – related to the aim of the CWH program – from two comprehensive self-administered nursing instruments. One instrument was the American Geriatric Institutional Assessment Profile (GIAP)\(^9\) which evaluates an organization’s capacity to create systematic change through an assessment of the organizational strengths.\(^{10}\) The GIAP is a comprehensive questionnaire (152 items); about one fifth of its items concerns the nurses’ geriatric practice and nurses’ perception about geriatric care. Some items and the entire subscale ASCD/Aging-specific Care Delivery fitted well with our specified domains to evaluate geriatric practice, and nurses’ perception of geriatric care and were, therefore, included in our initial questionnaire. Additional items from the Australian Older Patient in Acute Care Survey (OPACS) were also selected as this tool explores the health professional’s perception about quality of care necessary for elderly people.\(^{11}\) In particular, one of its three subscales (‘Section 1’) probes into the attitude of nurses towards caring for elderly patients. This subscale was only partially included (18 out of the 31 original items) in the initial questionnaire because we aimed for a concise questionnaire.

The initial questionnaire’s content was validated by performing three Delphi rounds in which the concept was presented to a panel of 16 experts (13 experienced geriatric nurses and 3 geriatricians) from ten large teaching and two university hospitals. In each round, the panel members assessed the relevance and formulation of the included items and then indicated whether any items were missing; newly proposed items were then introduced in the subsequent Delphi round. For each item, the content validity index (CVI) was calculated, and the item was accepted if CVI was >0.9.

Reliability, validity, and sensitivity to change
Next, internal consistency was assessed by calculating Cronbach’s alpha. To evaluate the questionnaire’s intra-reliability, intra-class coefficients (ICCs) were calculated between two repeated measurements that were performed in a group of surgical nurses with an interval of two weeks. To assess construct validity, we compared our results with expected differences between groups of nurses who work in surgical, medical, or geriatric departments. We expected the highest scores among the geriatric nurses, and we expected that medical department nurses would score higher than surgical nurses. This hypothesis was tested by using ANOVA statistics. We assessed the questionnaire’s sensitivity for measuring change using a paired two-sided Student’s \(t\)-test in a group of nurses (university medical center A) before and one year after implementing the CWH program.
Data collection
We invited six hospitals to participate in assessing the construct’s validity and internal consistency (see Table 1). In addition, university medical center B provided the data for the repeated measurements used for the test-retest analyses. Finally, nurses in the departments at the university medical center A (where the CWH program had been developed) additionally provided the data that were used to measure the questionnaire’s sensitivity to change.

Results

Questionnaire development and content validity
The expert panel recommended the removal as well as addition of a few items from the initial questionnaire. Just four items were rejected by the panel because they allegedly probed differences in attitudes towards elderly and younger patients. The experts argued that the focus of the questionnaire was on the elderly per se and not on comparisons. The items that were added by the panel members were related to the important role of informal caregivers, shared decision-making, and adjustments that are made to nurses’ working place in order to adapt to the needs of an elderly patient. Furthermore, the focus of the questionnaire was expanded from the nursing problems incontinence, restraint use, sleep and pressure ulcers (GIAP) to also include falls, delirium, malnutrition and promoting mobility.

Following three Delphi rounds (see Methods), the newly developed Geriatric In-hospital Nursing Care Questionnaire – written as “GerINCQ” (in Dutch: “GIDZ InZicht”) – contained five subscales. Two of these subscales (Performed Interventions and Aging-Sensitive Care Delivery (ASCD)) were designed to evaluate the geriatric practice at the team level, and the other three subscales (Professional Responsibility, Attitude towards Caring for Elderly Patients, and Perception of Caring for Elderly Patients) were aimed to evaluate geriatric practices, attitudes, and perceptions at the individual nurse level; see Table 2 (the complete questionnaire is provided as an E-appendix).

The final GerINCQ contains 67 items, all but one of which have a score that ranges from 1 to 5 with a higher score indicating a more positive geriatric attitude, perception, or practice (items 16, 17, and 21 require recoding as they reflect reversed scored). Responses range on a 5 point scale from negative to positive (or vice versa) with the exception of the subscale Performed Intervention, in which the most positive answer, and thus, the highest score, is centered in the middle of the range. Moreover, the maximum score is set on 4 (instead of 5), thus preventing a disproportionate weighting of this subscale on the total questionnaire score. The total questionnaire score is calculated as the mean of the five subscales and has a range of 1 to 4.8 with
a higher score indicating more positive geriatric practices, attitudes, and perceptions. It is completed electronically and takes 15 minutes.

**Subject description**
Data of 271 nurses from 11 departments in six teaching and university hospitals were included. The sample included 134 (49%) registered nurses at bachelor level and 112 (41%) at associate level. A complete description of the participants is provided in Table 1.

**Reliability, validity, and sensitivity to changes**
Table 2 summarizes all of the psychometric testing results. The GerINCQ has satisfactory internal consistency (the total $\alpha=0.86$; the subscales $\alpha$ values ranged

**Table 1** Study population (n=271 participants)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Outcome</th>
<th>N</th>
<th>%</th>
<th>mean</th>
<th>SD</th>
<th>range</th>
</tr>
</thead>
<tbody>
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<td>Gender</td>
<td>Female</td>
<td>237</td>
<td>87</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>34</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Age</td>
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<td>-</td>
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<tr>
<td>Profession</td>
<td>Nursing aide</td>
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<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Registered nurse – AD level 1)</td>
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<td>41</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Registered nurse – BSN level 2)</td>
<td>134</td>
<td>49</td>
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<tr>
<td></td>
<td>University Medical Center B</td>
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<td>23</td>
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<td>-</td>
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<td>Teaching Hospital C</td>
<td>40</td>
<td>15</td>
<td>-</td>
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<td>10</td>
<td>-</td>
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<tr>
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<td>Teaching Hospital E</td>
<td>26</td>
<td>10</td>
<td>-</td>
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<td>-</td>
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<tr>
<td></td>
<td>Teaching Hospital F</td>
<td>16</td>
<td>6</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Experience</td>
<td>As professional, in years</td>
<td>-</td>
<td>-</td>
<td>14</td>
<td>11.3</td>
<td>0-41</td>
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<tr>
<td></td>
<td>At current department, in years</td>
<td>-</td>
<td>-</td>
<td>6.3</td>
<td>6.6</td>
<td>0-32</td>
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<tr>
<td>Employment</td>
<td>Hours per week</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>6.2</td>
<td>12-40</td>
</tr>
</tbody>
</table>

- = not applicable
1) Registered Nurse – Associate level
2) Registered Nurse – Bachelor level
from 0.64 to 0.89). The intra-rater reliability was evaluated by comparing the test-retest results in a sub-group of 61 respondents; the analysis revealed significant agreement between the two testing times (the total ICC=0.87; the subscale ICC values ranged from 0.68 to 0.83). In addition, an ANOVA revealed significant differences between the medical, surgical, and geriatric nurses (p<0.05); as expected, the geriatric nurses scored the highest in all domains. To evaluate the sensitivity of the questionnaire to changes over time, 37 participants provided two measurements, i.e. before and one year after implementing the CWH program. Even with this relatively small number of participants, the analysis revealed a small but significant improvement with respect to geriatric practices, attitudes, and perceptions (p<0.05), and a high effect size (0.5) one year after the CWH program was implemented; the mean (±SD) improvement was 0.10 ± 0.22.

**Discussion**

The GerlNCQ was developed and validated for use as a tool to measure geriatric practices and attitudes towards and perceptions of geriatric care by hospital nurses. The items for this questionnaire, which is designed to be self-administered by nurses, were derived primarily from two international questionnaires, and its integrated content was first evaluated by a panel of experts. The GerlNCQ contains five subscales comprising 67 items, with a total composite mean score that has a range from 1 to 4.8. The questionnaire has high content validity, satisfactory reliability and construct validity, and was sensitive to change one year following implementation of a geriatric improvement program.

Compared to the GIAP, the content of the GerlNCQ is more concise (67 vs 152 items), focusing on just three domains (geriatric hospital practice, attitude and perception of hospital nurses), and domains are more richly explored. We have expanded the GIAP focus from incontinence, sleep, pressure ulcers and restraint use to include delirium, malnutrition, medication use and early mobility activation of the hospital patient. The geriatric practice component as assessed by the GIAP subscale (ASCD) is explored more in depth by adding items concerning the role of informal caregivers, shared decision-making, and nurses’ working pace. Attitude section is supplemented by 14 items from the OPACS.

The strength of this study lies in the fact that the validation process included a sufficient number and variety of participants (including 271 nurses from 11 departments in six teaching and university hospitals). Therefore, we assert that the positive results can likely be generalized to all hospitals within the Netherlands. We also propose that this questionnaire can be adapted for use in English-speaking countries, as it was derived from American and Australian questionnaires.
Table 2  Domains, Origin, and Psychometric Evaluation of the GerINCQ and Subscales

<table>
<thead>
<tr>
<th>GerINCQ subscales</th>
<th>Domain</th>
<th>Origin</th>
<th>Items</th>
<th>CVI</th>
<th>α</th>
<th>ICC (mean)</th>
<th>Medical N=123</th>
<th>Surgical N=101</th>
<th>Geriatric N=47</th>
<th>p</th>
<th>Before N=37 (mean)</th>
<th>After N=37 (mean)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Performed Interventions</td>
<td>Team’s geriatric practice</td>
<td>GIAP, q7</td>
<td>13</td>
<td>&gt;0.91</td>
<td>0.72</td>
<td>0.68**</td>
<td>3.2</td>
<td>3.2</td>
<td>3.4</td>
<td>0.02</td>
<td>3.23</td>
<td>3.36</td>
<td>0.32</td>
</tr>
<tr>
<td>2. Aging-Sensitive Care Delivery (=ASCD)</td>
<td>Team’s geriatric practice</td>
<td>GIAP, q10 + 4 added</td>
<td>13</td>
<td>&gt;0.90</td>
<td>0.88</td>
<td>0.83**</td>
<td>3.2</td>
<td>3.1</td>
<td>3.6</td>
<td>0.00</td>
<td>3.02</td>
<td>3.22</td>
<td>0.32</td>
</tr>
<tr>
<td>3. Professional Responsibility</td>
<td>Nurse’s attitude</td>
<td>GIAP, q16</td>
<td>12</td>
<td>&gt;0.91</td>
<td>0.89</td>
<td>0.83**</td>
<td>3.9</td>
<td>4.0</td>
<td>4.1</td>
<td>0.16</td>
<td>4.08</td>
<td>4.05</td>
<td>0.67</td>
</tr>
<tr>
<td>4. Attitude towards caring for elderly</td>
<td>Nurse’s attitude</td>
<td>OPACS, partly section 1</td>
<td>14</td>
<td>&gt;0.90</td>
<td>0.64</td>
<td>0.71**</td>
<td>3.8</td>
<td>3.7</td>
<td>4.2</td>
<td>0.00</td>
<td>3.75</td>
<td>3.83</td>
<td>0.18</td>
</tr>
<tr>
<td>5. Perception about caring for elderly</td>
<td>Nurse’s perception</td>
<td>GIAP, q 15, 17, 19, 20, 23, 24 + 4 added</td>
<td>15</td>
<td>&gt;0.91</td>
<td>0.67</td>
<td>0.76</td>
<td>3.1</td>
<td>3.0</td>
<td>3.8</td>
<td>0.00</td>
<td>3.13</td>
<td>3.28</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>GerINCQ, total</strong></td>
<td></td>
<td></td>
<td>67</td>
<td>0.86</td>
<td>0.87**</td>
<td>3.5</td>
<td>3.4</td>
<td>3.8</td>
<td>0.00</td>
<td>3.46</td>
<td>3.56</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

CVI = content validity index; α = Cronbach’s alpha; ICC = intra-class coefficient as a test-retest analyses

1) Significance level: *p<0.05; **p<0.01.
2) Range 1 – 5; a higher score indicates more positive practice, attitude, and perception (except subscale Geriatric interventions: range 1-4).
3) Refers to measurements obtained before and one year after implementing the CWH program.
Additional validation of the GerINCQ should focus on the questionnaire’s ability to identify differences between different hospital departments. The GerINCQ detected significant differences between groups of nurses, and this was likely due to the high scores obtained by the geriatric departments (the mean scores of geriatric, surgical, and medical departments were 3.8, 3.4, and 3.5, respectively). In contrast, and despite our *a priori* expectation, we did not find that the medical departments scored higher than the surgical departments. The GerINCQ should be evaluated further by focusing on the ability of the subscales to detect differences at the ward (unit) level; such an analysis would require a considerably larger study.

Interestingly, the GerINCQ may also be useful for determining the effect of in-hospital nursing care on outcomes in geriatric patients, such as preventing delirium or satisfaction. In this respect, it is generally believed that a strong relationship exists between professionals’ attitudes and perceptions, the quality of care they provide, and, ultimately, the outcomes although relatively few studies have directly tested this assumption. From this perspective, it is important to note that the GerINCQ subscale *Aging-Sensitive Care Delivery (ASCD)* has good reliability and validity (internal consistency: Cronbach’s $\alpha=0.83$; intra-rater reliability: ICC=0.83, $p<0.01$). This finding is important, as it is based on the GIAP’s subscale ASCD, which was used previously to study associations between the geriatric nurses’ practice environment and patient outcome. In this latter study, the patient outcomes were operationalized only by the nurses’ perception; nevertheless, this certainly paves the way for using the GerINCQ to directly study the association between geriatric nursing care and patient outcome. If an association is shown, it implies that the GerINCQ is not only useful during geriatric care implementation processes but also in conducting root analysis of poor patient outcomes. Another interesting factor of influence on patient outcomes is knowledge. In future research it might be interesting to expand the focus to include the level of nurses’ knowledge of geriatric care.

The value of using the GerINCQ in clinical practice will be amplified if it facilitates the implementation of geriatric improvement programs by hospital management. The GerINCQ was developed to monitor geriatric practices and nurses’ attitudes and perceptions because of the assumption that its results can potentially reveal specific weaknesses and strengths in a hospital’s nursing team. Armed with this information, the relevant department managers can then focus on implementing strategies designed to improve daily practices, nurses’ attitudes towards elderly patients, and/or their perception of caring for elderly patients. In our study, we have only second-hand experiences using the GerINCQ as a supporting implementation tool, as using it in such a way as the primary target was beyond the scope of our initial aim to develop and validate the tool. However, it is worth noting that the scores obtained on the GerINCQ tend to cluster towards the middle scores (i.e., low and high scores were relatively rare), thus, leading to small differences. The question remains whether
these small differences are meaningful enough to guide the implementation of programs designed for specific nursing teams. Because the GerINCQ detected changes following the implementation of the CWH geriatric care program, we believe that the GerINCQ can indeed help guide such an implementation strategy. This hypothesis may be tested in future studies.

In summary, given existing evidence that the hospital environment itself is not sufficiently safe for elderly patients, using a tool that can monitor nurses’ geriatric practices is increasingly important. It should be noted that the improvement in geriatric care is not necessarily limited to geriatric departments and units, but can be applied to medical and surgical departments as well. In this respect, a tool such as the GerINCQ is highly valuable, as it can be used to monitor and evaluate the practices, attitudes, and perceptions of nurses in a variety of hospital departments. The GerINCQ questionnaire is reliable, has satisfactory construct validity, and is sensitive to detect changes over time. Thus, the GerINCQ may facilitate the further exploration of the complex concept of optimizing geriatric care in hospitals and it can be used to study the effect of nursing care on specific elderly patient’s outcomes.
The Geriatric In-hospital Nursing Care Questionnaire (GerINCQ)

References

CHAPTER

5

The value of process evaluation and core process measures

Published as:
No abstract
TO THE EDITOR: We read with interest the article written by Lin et al.\textsuperscript{1} in which the authors described clearly the challenges of interpreting evidence from reviews of multi-component interventions designed to prevent functional decline in elderly persons. Because we also struggled recently with the collection of high-quality evidence from complex multi-component interventions to improve care for older adults\textsuperscript{2}, we support the proposal by Lin and colleagues to establish a standardized core set of measures and criteria to perform and report the results of research regarding complex interventions. However, how this might be accomplished remains an important question.

Lin et al.\textsuperscript{1} presented a framework with important questions that must be answered in order to understand the heterogeneity in clinical trials and—related to these questions—provide considerations for future research regarding the health and functional decline of older adults. In this respect, we agree that introducing “core clinical outcomes” in a given research area would likely facilitate comparisons and thereby enhance our ability to make informed decisions and policies. For example, in the Netherlands, this strategy is currently implemented in all research projects within the National Care for the Elderly Program, requiring the collection of data from a Minimum Data Set (MDS) in order to compare the project results nationally.\textsuperscript{3} In addition, researchers attempt to develop a meaningful composite outcome measure from this MDS to evaluate complex interventions for treating elderly people with complex needs.\textsuperscript{4}

However, one issue that Lin et al. did not explicitly address—and which in our opinion is essential for comparing trials with similar complex interventions—is the incorporation of process evaluations. Process evaluations facilitate the interpretation of outcome results by documenting and evaluating the mechanisms and processes in detail.\textsuperscript{5} Process evaluations are being published at an increasing rate; entering the search term “process evaluation” in PubMed retrieves 33 articles that were published in 2000, 58 in 2005, and 145 in 2012. Process evaluations can be used for several purposes, which reflect the challenges described by Lin et al. For example, Reelick et al. developed a useful framework to gain insight into the recruitment success rates and characteristics of study populations, the execution of complex interventions, and the acquisition of data.\textsuperscript{6} This framework can therefore be used for process evaluations to overcome challenges in understanding targeted populations and complex interventions. Leontjevas et al. demonstrated the value and importance of process evaluations in determining which statistical effect analysis should be performed to best understand internal and external validity, as this validity can influence the presentation and interpretation of effects.\textsuperscript{7} Thus, process evaluations can also be used to overcome challenges in performing outcome analyses. Moreover, although qualitative process evaluations are still rarely included in randomized trials of complex healthcare interventions, these evaluations can be valuable, for example to examine
whether the intervention was delivered as intended, to investigate processes of implementation/changes, to explore the experiences of important actors with the intervention, and to provide data that can be used to interpret the findings and/or help explain variations in effectiveness.8

Thus, if process evaluations are to be included, how should they be structured to limit heterogeneity in their results? In order to perform process evaluations in a given subject area, both a set of “core process measures” for performing process evaluations and a set of “core clinical outcomes” are needed. For example, core process measures could be based on components of the Normalization Process Theory (NPT), which is particularly useful for understanding (the degree of) implementation, embedding, and integration of innovative complex interventions in healthcare organizations.9 In addition, process evaluations often describe implementation fidelity as the degree to which an intervention actually has an impact on the outcomes.10 Therefore, a degree of implementation should be considered an effect outcome measure that is composed of both quantitative and qualitative data.

In conclusion, providing details regarding the complex processes of conducting trials on multi-component interventions in the (frail) elderly enables researchers and policy-makers to determine the value of these complex interventions. Process evaluations should be an explicit and pre-existing component when designing trials of complex interventions; specifically, we suggest that these evaluations (1) incorporate “core process measures” that describe the degree of implementation of the intervention in the trial, (2) should be published alongside the results of their effect studies, and (3) should also be incorporated into systematic reviews. Research and guidelines regarding which “core process measures” should be used in geriatric research are needed.
The value of process evaluation and core process measures

References

A graph summarizing results of process evaluation and process measures

Published as:
FC Bakker, A Persoon, Y Schoon, MGM Olde Rikkert.
Uniform presentation of process evaluation results facilitates the evaluation of complex interventions: development of a graph.
Abstract

Rationale, aims and objectives: Process evaluation is a highly essential element for the increasing number of studies regarding multi-component interventions. Yet, researchers are challenged to collect and present appropriate process outcomes in such way that it is easy and valuable to be used by other researchers and policy-makers in interpreting and comparing intervention effects, due to the absence of standards for conducting and publishing process evaluation. This article describes the development of a method to concisely summarise the results of process evaluations of complex multi-component interventions.

Methods: Development of a graph with the aim to facilitate the reporting of process evaluation’s results, based on a narrative review of the literature for process measures used in complex interventions for elderly people.

Results: 17 articles of process evaluations alongside effect studies of complex interventions were reviewed. From these articles it was found that process evaluations should address whether the intervention (1) was implemented successfully, (2) was evaluated properly, and (3) can be continued in the future. A flowchart based on the essential components of an adequate process evaluation was developed. A simplified but highly informative figure reporting a summary of the results of the process evaluation is proposed and its use is explained by administering the figure to two studies including a process and effect evaluation of a complex intervention.

Conclusion: A graphical approach – which includes the core results of process evaluation and can be used directly in reporting effectiveness studies – will help researchers and policy-makers to interpret and compare effects of complex multi-component interventions.
Introduction

Evaluating and reporting multi-component interventions in health care is a complex process that an increasing number of researchers face when trying to evidently improve care for patient groups with multiple chronic conditions or frailty characteristics.\textsuperscript{1,2} To facilitate this process, the Medical Research Council (MRC) has provided guidance on the development, evaluation and implementation of complex interventions, including encouraging the use of process evaluation alongside outcome evaluation.\textsuperscript{3} The results of such process evaluations can facilitate understanding the study’s results and can allow researchers and policy-makers to develop, implement, optimise, and evaluate complex interventions. Importantly, as in order to generate comprehensive evidence and stimulate the transition of research into practise, one must provide a clear description of the intervention, the outcome evaluation – e.g. using guidelines of the EQUATOR network (Enhancing the QUAlity and Transparency Of health Research\textsuperscript{4}) – as well as of the implementation processes.\textsuperscript{5} However, the MRC nor others have provided uniform guidance regarding process evaluations, even though a clear presentation of process measures is essential for allowing researchers and policy-makers to reproduce complex interventions as well as to easily present, interpret and systematically review/compare results of complex intervention studies. This need has already been emphasised and diverse process measures have already been proposed by various researchers\textsuperscript{6-12} Moreover, because most reports regarding process evaluations are extremely lengthy and detailed, quickly scanning to identify relevant information and obtaining an overall judgement of the process evaluation and the intervention can be highly challenging. To overcome these challenges of both selecting and presenting process outcomes, we aimed to develop a graphical approach to concisely summarise the results of process evaluations of complex multi-component interventions.

Methods

Review of process measures as reported in complex health interventions

In order to determine which core elements of process evaluations have been published by researchers, and how these were presented, we searched in PubMed for studies including process evaluations of studied complex interventions (until April 2013). To focus on healthcare interventions for elderly persons, we used the following search terms in either title or abstract: ‘aged’, ‘older people’, ‘older persons’, ‘older adults’, ‘elderly’, ‘frail’, ‘nursing home’ or ‘home for the aged’, which we combined with ‘process evaluation’, ‘program’ or ‘intervention’, and with ‘process evaluation’, ‘process outcome’, ‘mixed method’, ‘multiple method’, ‘multi-method’, ‘triangulation’
or ‘multidimensional’, and finally with ‘complex intervention’, ‘multidisciplinary’, ‘multilevel’, ‘multicomponent’, ‘multifaceted’, ‘integrated care’, or ‘tailored’. In total, 223 articles were retrieved. Articles which are written in English and describe a performed process evaluation which was performed alongside an effect study were included for analyses. Pilot studies and protocols were excluded. 17 articles could be included in this review. From these studies, we subtracted the main characteristics regarding the intervention, goals, elements and value of process evaluations into a table (online Appendix A). Next, we summarized the results regarding the last three variables into a matrix, from which main themes were deducted subsequently, which formed the base of the graphs.

Graphical representation
Perera et al. proposed a graph containing a simplified representation of the intervention’s components, time frame and design in order to obtain a clear description of a complex intervention. We propose to incorporate the results of process evaluations that were collected during the review process into this figure to obtain a clear description of process measures and outcomes as well.

Results

Process measures
Based on recent studies and our review of published literature regarding process evaluations among elderly subjects (17 studies, see online Appendix A), we propose that process evaluations should basically answer the following three questions in order to summarise, interpret and compare the results of intervention studies:
1. Was the intervention implemented successfully?
2. Was the intervention evaluated properly?
3. Can the intervention be sustained in the future?
The first question addresses the delivery, feasibility and acceptability of an intervention. The second question allows one to judge the level of the study’s evidence with respect to effectiveness of the intervention and is based upon which data were collected and how they were collected. This information is essential when the results are negative, as it is important to determine whether the intervention was ineffective and/or whether the data collection was not appropriate. The answer to the third question will provide important information regarding the likelihood of continuing and implementing the intervention in the future. In other words, if an effective intervention is currently integrated into usual practise and if financing is currently being arranged, the intervention is likely sustainable and therefore worth implementing and/or studying elsewhere. Accordingly, an adequate evaluation of an intervention’s sustainability is
Figure 1 Core elements of a process evaluation alongside a complex intervention study.
## Chapter 6

### Time line

<table>
<thead>
<tr>
<th>CareWell in Hospital program</th>
<th>Usual care (control)</th>
</tr>
</thead>
</table>

#### CareWell in Hospital program

<table>
<thead>
<tr>
<th>Time frame</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24h after admission to hospital</td>
<td>[a]</td>
</tr>
<tr>
<td>&lt;48h after admission to hospital</td>
<td>[b] [c] [d]</td>
</tr>
<tr>
<td>during hospital stay</td>
<td>[e] [f] [g] [h] [j]</td>
</tr>
<tr>
<td>&lt;24h before discharge</td>
<td>[j]</td>
</tr>
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</table>

#### Usual care (control)

<table>
<thead>
<tr>
<th>Time frame</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>[a]</td>
</tr>
</tbody>
</table>

#### Measurements of primary effect outcomes

- First triage: questionnaire competed by a nurse to determine whether or not a patient (70 years) has a risk of either delirium, falls, physical decline or malnutrition. If so, the CareWell team will be consulted.
- Second triage: geriatric nurse determines frailty of patient. If frail, the patient receives interventions of the CareWell in Hospital program.

#### Measurements of secondary effect outcomes

- Performance of a medication review. Results of the medication review are included in the CareWell plan.
- Performance of a comprehensive geriatric assessment. Results of the geriatrics nurse or at request of the physician of the department. Results are incorporated in the CareWell plan.
- Performance of a weekly multidisciplinary meeting with geriatric input discussed, with additional attention to discharge planning.
- Update of the CareWell plan at discharge issues to be acted on by the primary care physician, to be discussed, with additional attention to discharge planning.
- Update of the CareWell plan at discharge issues to be acted on by the primary care physician, to be discussed, with additional attention to discharge planning.
- Education of nurses and physicians of the departments by the CareWell team, at therapeutic activities by trained volunteers.
- Education of nurses and physicians of the departments by the CareWell team, at therapeutic activities by trained volunteers.
- Follow-up of the patient by the CareWell team when necessary.
- Follow-up of the patient by the CareWell team when necessary.
- Structural financing arranged: yes
- Cost calculated: yes
- Cost-effectiveness studied: yes

#### Population

- Recruitment: 66.6% in study
- Recruitment: 65.2% in study
- Reach: 31.2% received CWH
- Reach: N.A.

#### Data collection

- Missing data: 31.3% in >1 of 3 primary outcomes (due to dynamic hospital setting)
- Missing data: 45.0% in >1 of 3 primary outcomes (due to dynamic hospital setting)

#### Validity

- Internal validity: yes
- External validity: partially

#### Adoption

- Integrated: yes
- Continues: yes
- N.A.

#### Financing

- Structural financing arranged: yes
- Cost-effectiveness studied: yes
- N.A.

### Legend

- Orange: Satisfactory implementation, delivery and/or compliance
- Green: Moderate implementation, delivery and/or compliance
- Red: Insufficient implementation, delivery and/or compliance

### Elderly patients 70 years of age and older – a process evaluation was performed. The figure provides a graphical representation of both the design and content of the program as well as the results of the process evaluation.
A graph summarizing results of process evaluation and process measures

**Figure 2** Design and content of the CareWell in Hospital program and results of its process evaluation.

Alongside the before-after study of the CareWell in Hospital program – a multi-component intervention to improve the quality of hospital care for frail elderly patients 70 years of age and older – a process evaluation was performed. The figure provides a graphical representation of both the design and content of the program as well as the results of the process evaluation.
now a common condition of applying for a grant. In order to operationalize these three questions, we developed a flowchart based on the essential components of an adequate process evaluation derived from the published literature (Figure 1).

**Graphical representation**

Next, to allow the inclusion of the results of these process measures into articles of effect studies, we recommend reporting a summary of the results of the process evaluation in the simplified figure proposed by Perera et al. More detailed additional information regarding the process (for example: underlying implementation theory, barriers, facilitators, moderating factors, and protocol deviations) should be made publicly available, e.g. in a process evaluation article, online in an online Appendix, or upon the author’s request. Below, we illustrate how incorporation of process measures into the figure of Perera et al. can be accomplished by using performed process evaluation of two different studies.

**Example 1: Process results of the CareWell in Hospital program**

We piloted the CareWell in Hospital program and conducted a before-after study that included a mixed-methods process evaluation. Figure 2 shows the design and content of the program based upon the figure published by Perera et al. The squares containing lower-case letters represent obligatory or fixed parts of the multi-component intervention, and the circles present optional or flexible components. The individual intervention components are colour-coded to indicate the extent to which they were implemented satisfactorily, which is useful for determining at a glance whether the intervention was delivered successfully. The criteria for the various rates (i.e. colours) of component delivery are listed in the legend. Ideally, these criteria should be predefined; however, they can also be determined post-hoc. Furthermore, Figure 2 provides information regarding the quality of the scientific evaluation and the potential for the intervention to both continue and expand to other sites and/or populations. From Figure 2, we can see (1) that some intervention elements were not implemented satisfactorily, (2) that one-third of the study population actually received the intervention, and (3) that the intervention has dissemination potential. In addition, providing longitudinal process evaluation measures would be highly informative; this could be added to the Figure by adding distinct time data to the legend. Adding this information might facilitate understanding the implementation progress curve and gives consideration to the often dynamic nature of implementation processes.
Example 2: Process results of the Helping Hands study

For another example of a complex intervention, we selected the cluster randomised controlled trial called “Helping Hands”, which evaluated the success of two strategies designed to improve the compliance of hand hygiene in hospitals.\textsuperscript{16-18} A detailed description of the process evaluation—particularly with respect to the delivery of and adherence to its various components—is also available.\textsuperscript{19} This information enabled us to create Figure 3, which graphically depicts the components of the two hand hygiene strategies and confirms that both strategies were implemented satisfactorily and evaluated thoroughly. Detailed information regarding the delivery of and adherence to the various components was available, which enabled the study authors to perform component analyses. Figure 3 also illustrates that relatively little is known regarding the adoption and continuation of the intervention, even though sustainability is an important prerequisite for the future implementation of these hand hygiene interventions.

Visualising the interventions’ implementation, evaluation and dissemination characteristics and including such graph in studies on intervention effectiveness provides quick insight to core process outcomes which is essential in evaluation of complex interventions next to effectiveness data. Summarizing core process measures stimulates both a more conscious interpretation of results and comparison of studies on important parameters without the need to search for information in reports with extensive data. In case more detailed analyses of the intervention and implementation processes is required, the selected set of core process measures may serve as valuable framework to collect or overview the available data.
Alongside the cluster randomised controlled trial called “Helping Hands” – which evaluated multi-component strategies to improve hand hygiene compliance in hospitals – a process evaluation was performed. The figure provides a graphical representation of both the design and content of the trial and intervention as well as the results of the process evaluation.

### Time line

<table>
<thead>
<tr>
<th>0 + 6 months</th>
<th>baseline measurements</th>
</tr>
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</table>

#### Randomisation

<table>
<thead>
<tr>
<th>0-6 months</th>
<th>12 + 18 months</th>
<th>measurements of outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a b c d e f g</td>
<td>a b c d e f g</td>
<td></td>
</tr>
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### Population

<table>
<thead>
<tr>
<th>recruitment: 100%</th>
<th>reach: 66.7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>(33.3% received only a-b-c-d)</td>
<td></td>
</tr>
<tr>
<td>recruitment: &gt;100%</td>
<td>reach: 100%</td>
</tr>
<tr>
<td>(37 wards instead of 30)</td>
<td></td>
</tr>
</tbody>
</table>

### Data collection

| missing data: 0% |

### Validity

| internal validity: unknown |
| external validity: yes |

### Adoption

| integrated: unknown |
| continues: unknown |
| cost calculated: yes |
| cost-effectiveness studied: yes |

### Financing

| structural financing arranged: no |
| cost calculated: yes |
| structural financing arranged: no |
| cost-effectiveness studied: yes |
Figure 3  Design and content of the Helping Hands trial and results of its process evaluation.

Alongside the cluster randomised controlled trial called “Helping Hands” – which evaluated multi-component strategies to improve hand hygiene compliance in hospitals – a process evaluation was performed. The figure provides a graphical representation of both the design and content of the trial and intervention as well as the results of the process evaluation.
Discussion

There is consensus among the published literature that the results of process evaluations are an essential element for evaluating complex multi-component interventions. Therefore, a process evaluation should be pre-planned in line with the clinical outcomes’ evaluation. The results of the evaluation should be incorporated in articles that describe the effects of those interventions, including systematic reviews. To ensure that the extensive amount of process data is both manageable and interpretable for researchers and policy-makers, we developed and recommend to use a new graph for summarizing core process measures.

Methodologically, the graph rightfully raises questions regarding which effectiveness and process data should be measured and which norms should be taken to predefine successful implementation of the intervention and to determine clinical relevance of outcome data. Consequently, this graph may aid the critical appraisal of primary studies as well as performing mixed-method systematic reviews of heterogeneous and complex interventions and therefore may help researchers and policy-makers determine which complex multi-component interventions were truly successful. Note that, for understanding and explaining implementation processes in relation to impacts in detail, more elaborated evaluation data or theories also have to be considered. Yet, in representing all relevant basic information regarding the content, evaluation, and dissemination characteristics of the intervention within one single figure, such a graph will likely encourage the translation of research into practice.

The graph can thus be used as a tool to visualize essential information on the intervention and study and thereby forms the basis for interpreting and comparing results and answering three important questions concerning intervention implementation, evaluation and continuation. In addition, awareness regarding the importance and value of process evaluation may be raised by starting to incorporate basic results of process evaluation into articles of effect studies using this accessible approach. Therefore, we invite other researchers to use this tool for reporting process evaluations of complex interventions and to further refine it.
References


A graph summarizing results of process evaluation and process measures
CHAPTER 7

Evaluation of the CareWell in Hospital program

Published as:
FC Bakker, A Persoon, SJH Bredie, J van Haren-Willems, VJ Leferink, L Noyez, Y Schoon, MGM Olde Rikkert. The CareWell in Hospital program to improve the quality of care for frail elderly inpatients: Results of a before-after study with particular focus on surgical patients.
Abstract

**Background:** Objective was to evaluate implementation of an innovative intervention designed to prevent complications and stimulate early rehabilitation among frail elderly inpatients.

**Methods:** The program was implemented in April 2011. A mixed-methods process evaluation and before–after study were performed. Primary effect outcomes included incidence of hospital-acquired delirium, cognitive decline, and decline in activities of daily living (ADL) during hospital stay. Secondary endpoints included ADL performance three months post-discharge, readmission, and caregiver burden.

**Results:** 191 pre-intervention and 195 post-intervention patients age ≥70 years were included. Overall, no significant differences in primary endpoints were found. Mean ADL between discharge and follow-up improved: 3.2 vs. 5.7, \( p = 0.058 \). Caregivers rated burden of care lower at three months post-discharge: 0.5 vs. -0.6, \( p = 0.049 \).

**Conclusions:** CWH was implemented satisfactory. Although the low baseline delirium incidence (11%), higher co-morbidity and an increasing learning curve during a restricted implementation period potentially influenced the overall effects, this integrated care program may have beneficial effects on outcomes among frail elderly surgical patients.
Introduction

Hospital-acquired delirium and disability among elderly patients are serious medical problems\textsuperscript{1-4}, which are caused by the patient’s disease and frailty\textsuperscript{5} as well as by the inhospital procedures, particularly in non-geriatric surgical departments. This high prevalence of problems among non-geriatric surgical departments is due to their invasive interventions, generally inadequate knowledge of—and attention to—geriatric patients, non-standardized geriatric practices such as screening for delirium and falls, and insufficient continuity of care both during and after the hospital stay (due to a general lack of communication and cooperation between various care providers).\textsuperscript{1,6} It is therefore important to understand how and which innovative care practices, in addition to specialized departments\textsuperscript{7,8} and quality indicators\textsuperscript{9} can best improve hospital outcomes for elderly patients\textsuperscript{8} in internal medicine departments and particularly in surgical departments as an increasing number of frail elderly people are expected to undergo a surgical procedure.\textsuperscript{4,10}

To address this need, the CareWell in Hospital (CWH) program was developed and pilot tested\textsuperscript{11} as a so-called “transition experiment”. This explicitly implies that this program aims for important and structural changes in the healthcare services that are currently offered. The intended adaptations and changes in care structure, processes, and outcomes (or: full implementation of the program) may take longer than the development and evaluation period that was sponsored by the grant.

CWH is based on the Hospital Elder Life Program (HELP)\textsuperscript{12,13} and comprises two main concepts: (1) proactive and intensive support by a CareWell geriatrics team in order to improve patient-centered care for frail elderly patients and increase awareness and competency among nurses and physicians with respect to providing geriatric care; and (2) the introduction of a team of trained volunteers in order to offer activities for timely cognitive and physical stimulation to patients and to integrate care and well-being directed activities within the hospital. The goal of CWH is for all inpatients age 70 years and older and who are identified as being frail to receive a tailored care plan (the CareWell plan) in order to ensure optimum prevention strategies for hospital-associated and peri-operative complications, such as hospital-acquired delirium and functional decline.

The primary objective of this study was to evaluate the transition towards integrated care by monitoring CWH implementation processes and the effects of CWH on the quality, safety, and efficiency of hospital care received by frail elderly patients in three hospital departments at a Dutch university hospital. In this article, particular attention is given to two surgical departments as compared to a medical department.
Methods

Ethics
This study was approved by the medical center’s Dutch Research Ethics Review Committee. Written informed consent was not required for this study, as CWH was considered a quality improvement project and not a medical experiment. Each participant provided verbal consent. The study was registered at www.clinicaltrials.gov (NCT01273116).

Study design
A before-after study was performed in two surgical departments and one internal medicine department at Radboud University Nijmegen Medical Center, the Netherlands. This study included a mixed-methods process and an effect evaluation.

Intervention
CWH was developed as a complex intervention\textsuperscript{14}, including screening of all patients age 70 years and older for frailty, followed by several tailored interventions indicated by a proactive CareWell team (a geriatric nurse specialist and a geriatrician) and performed by the department’s nurses and physicians, a team of trained volunteers and continuous education of physicians and nurses (see Figure 1 and Appendix A). To enhance and monitor the progress and integration of CWH in usual care, three types of structural meetings with professionals within the departments were organized (monthly and two-weekly) before and during the one-year implementation period. E-Appendix A provides a detailed description of the content and implementation procedures of CWH.\textsuperscript{15}

Setting
From April 1, 2011, CWH was implemented in three departments that represent the following medical specialties: vascular surgery, trauma surgery, abdominal oncology and surgical oncology (50 beds); cardiothoracic surgery (16 beds) and lung diseases (16 beds); rheumatic diseases (7 beds), infectious diseases and general internal medicine (27 beds). From the onset, process data (e.g., performed interventions) were collected continuously. Additional process data (e.g., adherence, interviews, etc.) were collected in September 2011, January 2012, and March-July 2012. Recruitment and data collection for the effect study occurred three months per department: from January 2011 until April 2011 (pre-implementation) and from March 2012 until July 2012 (post-implementation).
Participants

Every patient age 70 years or older was screened for frailty by nurses and by the CareWell team and could receive (parts of) CWH. For the effect study, patients were enrolled by a research assistant within 48 hours of admission. Patients were eligible if they were 70 years or older and when their expected length of stay was longer than 48 hours.

Figure 1 Schematic overview of the components of the CareWell in Hospital (CWH) program.

Upon admission (prior to surgery), patients were initially screened by nurses for their risk of experiencing delirium, falls, malnutrition, and/or physical decline during the hospital stay. If there is a risk of ≥1 items, a geriatric nurse judged whether or not the patient is frail and would benefit from (parts of) CWH. If so, a care plan with nursing, medical, and medication recommendations was offered to the nurses and physicians in the department. At the time of discharge, valuable information was provided for inclusion in the discharge letter to go to the primary care physician. If judged valuable, one or more of the four optional interventions (I through IV) was performed. CGA = Comprehensive Geriatric Assessment. Activities performed by volunteers are designed to provide cognitive and physical stimulation.
Outcome measures & Data collection

Process evaluation

Process evaluation to monitor the transition towards integrated care consisted of continuously monitoring intervention fidelity to enhance the effectiveness of implementation and to explain results. The intervention components that were actually performed and adhered to were documented. In addition, the degree of integration of the program in usual care was assessed by interviews with patients, volunteers, the CareWell team, nurses, and physicians, as well as by analyzing the minutes of the structural meetings.

Effect study

The primary outcomes included the incidence of hospital-acquired delirium, cognitive decline, and decline in ADL during hospital admission. These outcomes were chosen because these incidents require the most attention and because HELP has shown promising effects on these measures. The incidence of delirium was assessed in accordance with the criteria of the Confusion Assessment Method (CAM) by a trained research physician (who was not involved in the intervention) who interviewed the patient daily and obtained information from nurses and the medical/nursing files. Cognitive and physical functioning were assessed by a research assistant (who was not involved in the intervention) by administering the Dutch version of the Mini-Mental State Examination (MMSE) and the Groningen Activity Restriction Scale (GARS) at the time of admission and at the time of discharge. The GARS-ADL score ranges from 11 to 44, with a higher score indicating more or more severe disabilities.

The secondary outcomes included (unplanned) readmission within one month of discharge from Radboud University Nijmegen Medical Center, change in ADL functioning at three months follow-up relative to two weeks before admission and at discharge, and burden of care perceived by informal caregivers. The research physician determined whether or not the readmissions were unplanned based on pre-set criteria and clinical judgment. The Older Persons and Informal Caregivers Survey Minimum DataSet (TOPICS-MDS), which was provided by the study sponsor and included the GARS, was sent to the patients three months after discharge. During admission and three months after discharge of the patient, a written questionnaire (TOPICS-MDS for caregivers), including Self-Rated Burden of Care (SRB), was sent to the informal caregivers.

The research assistant and the research physician collected additional data regarding the following baseline characteristics from the patient and from the electronic medical file: age, gender, living situation, department (surgical or internal medicine), baseline MMSE, baseline GARS-ADL, admission type, readmission, length of stay (LOS), mortality, discharge destination, co-morbidity using the
Cumulative Illness Rating Scale – Geriatrics (CIRS-G) ranging from 0-56 with a higher score indicating more (severe) illnesses, ASA (American Society of Anesthesiologists) physical status classification, and complications.

Sample size
CWH is aimed to show a stability or improvement in function of 15% of the elderly patients and a reduction of 15% of delirium episodes. A loss of function in 30% of the elderly patients in usual care is assumed. Assuming 90% power and a 20% drop out rate for the first follow-up measurements, a group of a minimum of 160 patients before and 160 patients after implementation of CWH was intended to recruit.

Data analysis
Process evaluation
The performed and adhered interventions post-implementation are presented as frequencies and percentages. The degree of transition towards integrated care was determined using constructs of the Normalization Process Model in analyzing the interviews and minutes of the meetings. The results were categorized into the following four constructs: interactional workability (do all actors do what they need to do?), relational integration (do all actors know and trust each other’s work?), skill set workability (who is responsible for what?), and contextual integration (does the organization facilitate implementation?).

Effect study
The research assistant checked all of the data for accuracy and completeness. The data were analyzed using the statistical software program SPSS version 18.0. The Student’s t-test was used for continuous data that were distributed normally; the Mann-Whitney U test was used for data that were not distributed normally. The Chi-square test was used to compare categorical data; the Fisher’s exact test was used in case of little data per category. Differences were considered to be statistically significant if \( p<0.05 \) (for two-tailed tests).

For each primary outcome, we only included respondents with complete data. Cognitive decline was considered clinically relevant if the MMSE scores differed by \( \geq 2 \) points between admission and discharge (in accordance with the original HELP study). Decline in ADL was considered clinically relevant if the GARS-ADL score differed by \( \geq 3 \) points between two weeks before admission and at discharge (this change in score reflects an approximately 10% decline in ADL and represents a new ADL disability).

A composite outcome measure was created by summing the z-scores of the three individual primary outcome measures in order to evaluate potential confounders using multiple linear regression analyses (univariate General Linear Model). In this
analysis, patients with complete data regarding all three outcome measures were included, after checking that missing data did not influence the composite outcome measure. Subgroup analyses were performed for the two surgical departments.

Results

Participants
From start of the implementation, April 2011 to July 2012, 1703 medical and surgical patients age ≥70 years were admitted ≥48h of whom 649 were judged to be frail (38%) and benefitted from the program. Regarding the effect measures, 370 medical and surgical patients were admitted during the pre-implementation enrollment period, 298 of these patients met the eligibility criteria (81%), and 191 (120 surgical) of these patients were included in the analyses (64%). During the enrollment period one year after CWH implementation (i.e., the post-implementation measurements), 430 medical and surgical patients were admitted, 303 of whom met the eligibility criteria (71%), and 195 (121 surgical) of these patients were included in the analyses (64%). See Figure 2 for the study flowchart. The reasons for exclusion included delirium at admission, and relatively high patient refusal to participate and logistic difficulties as patients in Dutch hospitals undergo many interviews and procedures within a short period of time. Note that these excluded patients from the measurements might have benefitted from the program when judged frail. The patients who were included in the analyses were not statistically significant different from the excluded patients with respect to age, gender, department (surgical/internal medicine), admission type, or mortality. Table 1 lists the characteristics of all patients who were included in the study. The post-implementation patients had significantly higher CIRS-G total scores, reflecting a higher morbidity burden, and the post-implementation patients who underwent surgery had significantly higher ASA scores. In the surgical departments, most admissions were planned admissions. Among the 195 medical and surgical patients who were included in the effect study, 62 (32%) received parts of CWH, and all 195 patients have been screened for frailty.

Process outcomes
Table 2 shows the variation among the performed and adhered interventions. Performance of the specific CWH elements by the CareWell team varied from 11% of the patients discussed in a multidisciplinary meeting to 95% of the patients for whom a CareWell plan was developed. Adherence to the indicated interventions by the departments and volunteers ranged from 37% for consulting a dietician to 100% for additional discharge planning. Awareness, alertness, and being proactive with respect to elderly care increased (interviews). Both screening by nurses and adherence to the recommendations have received considerable attention since the
The initial criteria included patients age 70 years and older who were admitted to the hospital for longer than 48 hours. Patients who did not understand Dutch, were admitted less than 48 hours, had a contagious disease, were terminally ill, and/or were treated by a medical specialist from another department were excluded from the trial.

start of the program and continue to increase (first screening: 61% in September 2011, 71% in January 2012, and 76% in May 2012). The work of volunteers was qualitatively highly appreciated by the nursing staff. However, because CWH is the first program in the Netherlands to implement volunteers work in this way, integrating the work of volunteers into the department’s daily routine required time, resulting in an adherence rate of 46%. The multidisciplinary meeting, the results of the medication review, and the information for the discharge letter were integrated gradually during the implementation period, as this required ongoing motivational and educational strategies with respect to surgical and non-surgical professionals. Performance of the Comprehensive Geriatric Assessment (CGA: 42%) and medical history by proxy (32%) were frequently part of the work of the CareWell team and, among others, served to indicate the important elements of the CareWell plan.

Figure 2  Flowchart of patients enrolled in the CWH before-after study.
Table 1 Characteristics of the CareWell in Hospital (CWH) study population

<table>
<thead>
<tr>
<th></th>
<th>Pre-CWH (n=191)</th>
<th>Post-CWH (n=195)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Department, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical</td>
<td>120 (63%)</td>
<td>121 (62%)</td>
<td>0.875</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>71 (37%)</td>
<td>74 (38%)</td>
<td></td>
</tr>
<tr>
<td>Surgery, n (%)</td>
<td>121 (63%)</td>
<td>125 (64%)</td>
<td>0.878</td>
</tr>
<tr>
<td><strong>ASA classification, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I &amp; II</td>
<td>34 (31%)</td>
<td>20 (20%)</td>
<td>0.049</td>
</tr>
<tr>
<td>III &amp; IV</td>
<td>74 (69%)</td>
<td>82 (80%)</td>
<td></td>
</tr>
<tr>
<td><strong>Age at admission, years ± SD</strong></td>
<td>77.3 (5.2)</td>
<td>76.7 (5.4)</td>
<td>0.149</td>
</tr>
<tr>
<td>Surgical patients</td>
<td>120 (76.5)</td>
<td>121 (76.0)</td>
<td>0.284</td>
</tr>
<tr>
<td><strong>Gender, male (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ind. alone</td>
<td>57 (31%)</td>
<td>49 (26%)</td>
<td>0.462</td>
</tr>
<tr>
<td>Ind. together</td>
<td>118 (63%)</td>
<td>132 (69%)</td>
<td></td>
</tr>
<tr>
<td>Care institution</td>
<td>11 (6)</td>
<td>9 (5)</td>
<td></td>
</tr>
<tr>
<td><strong>CIRS-G</strong>, total score ± SD**</td>
<td>12.3 (4.3)</td>
<td>13.9 (5.3)</td>
<td>0.008</td>
</tr>
<tr>
<td>Surgical patients</td>
<td>120 (12.1)</td>
<td>121 (12.3)</td>
<td>0.987</td>
</tr>
<tr>
<td><strong>MMSE† baseline ± SD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical patients</td>
<td>178 (26.2)</td>
<td>191 (26.5)</td>
<td>0.312</td>
</tr>
<tr>
<td><strong>ADL‡ baseline ± SD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical patients</td>
<td>114 (26.6)</td>
<td>117 (27.3)</td>
<td>0.334</td>
</tr>
<tr>
<td><strong>Admission type, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td>191 (46)</td>
<td>195 (65)</td>
<td>0.095</td>
</tr>
<tr>
<td>Elective</td>
<td>108 (57)</td>
<td>91 (47)</td>
<td></td>
</tr>
<tr>
<td>From other hosp./depart.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerg. surg.</td>
<td>37 (19)</td>
<td>39 (20)</td>
<td></td>
</tr>
<tr>
<td>Elect. surg.</td>
<td>83 (69)</td>
<td>72 (60)</td>
<td></td>
</tr>
<tr>
<td>From other surg.</td>
<td>24 (20)</td>
<td>27 (22)</td>
<td></td>
</tr>
<tr>
<td><strong>Admission is readmission, n (%)</strong></td>
<td>191 (21)</td>
<td>195 (22)</td>
<td>0.900</td>
</tr>
<tr>
<td>Surgical patients</td>
<td>119 (13)</td>
<td>120 (12)</td>
<td>0.815</td>
</tr>
<tr>
<td><strong>Length of stay, days ± SD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical patients</td>
<td>120 (8.3)</td>
<td>121 (8.3)</td>
<td>0.613</td>
</tr>
</tbody>
</table>
Primary effect outcomes

The incidence of hospital-acquired delirium was 11% (n=20) before CWH implementation and 10% (n=20) after CWH implementation (p=0.945), among all medical and surgical patients. See Table 3. The incidence of cognitive decline of ≥2 points on the MMSE was 15% before CWH implementation and 12% after implementation (p=0.431). The incidence of ADL decline of ≥3 points on the GARS-ADL scale was 37% before implementation and 47% after implementation (p=0.088). No potential confounders were identified using the composite outcome measure.

It is important to note that among the 11 ADL questions at discharge, the most common missing items were “walking stairs”, “walking outside”, and “taking care of feet and toes”, particularly in the pre-implementation study population. When these three ADL items were excluded from the analysis, the incidence of ADL decline was 31% (n=48) vs. 34% (n=55) for pre-implementation and post-implementation, respectively (p=0.544).
Secondary effect outcomes

The results for the entire sample revealed improved ADL functioning at three months follow-up compared to the time of discharge ($p=0.058$). The readmission rate for the pre-CWH group was 11% versus 15% for the post-CWH group ($p=0.240$); of which 62% versus 72%, respectively, were unplanned readmissions ($p=0.432$). Informal caregivers rated their burden of care lower at the three-month follow-up, at a scale of 0-10 ($p=0.049$). See Table 3.

Table 2  Fidelity and adherence to components of the CareWell in Hospital program

<table>
<thead>
<tr>
<th></th>
<th>Indicated by CareWell team</th>
<th>Adherence by departments (full or partial)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$N$</td>
<td>$n$</td>
</tr>
<tr>
<td>Frail patients</td>
<td>195</td>
<td>62</td>
</tr>
<tr>
<td>CareWell plan</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>Day program delirium</td>
<td>58</td>
<td>28</td>
</tr>
<tr>
<td>Orientation points</td>
<td>58</td>
<td>41</td>
</tr>
<tr>
<td>Consult physiotherapist</td>
<td>58</td>
<td>34</td>
</tr>
<tr>
<td>Falls sensor</td>
<td>58</td>
<td>13</td>
</tr>
<tr>
<td>Consult dietician</td>
<td>58</td>
<td>19</td>
</tr>
<tr>
<td>Registration food intake</td>
<td>58</td>
<td>23</td>
</tr>
<tr>
<td>Day program activities</td>
<td>58</td>
<td>29</td>
</tr>
<tr>
<td>Discharge planning</td>
<td>51</td>
<td>8</td>
</tr>
<tr>
<td>Medication review</td>
<td>62</td>
<td>58</td>
</tr>
<tr>
<td>CGA* by geriatrician</td>
<td>62</td>
<td>26</td>
</tr>
<tr>
<td>Medical history by proxy</td>
<td>62</td>
<td>20</td>
</tr>
<tr>
<td>Multidisciplinary meeting</td>
<td>62</td>
<td>7</td>
</tr>
<tr>
<td>Volunteers</td>
<td>62</td>
<td>52</td>
</tr>
<tr>
<td>Therapeutic activities</td>
<td>52</td>
<td>48</td>
</tr>
<tr>
<td>Orientation</td>
<td>52</td>
<td>31</td>
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<tr>
<td>Mobilizing</td>
<td>52</td>
<td>8</td>
</tr>
<tr>
<td>Nutrition</td>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>Information in discharge letter</td>
<td>39</td>
<td>29</td>
</tr>
</tbody>
</table>

*CGA = Comprehensive Geriatric Assessment. NA = Not Applicable; - = no detailed numbers available. The range listed represents the percentage of patients for whom adherence is confirmed (the lower value) to the percentage of patients for whom adherence is likely but not confirmed (the upper value). Volunteers: 46% represents the mean percentage of visits that are performed of the total which could be performed (data from 49 patients was available).
### Table 3: Primary* and secondary† outcomes of the CareWell in Hospital program (CWH)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Pre-CWH (n=191)</th>
<th>Post-CWH (n=195)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Delirium, n (%)</td>
<td>191</td>
<td>20 (11)</td>
<td>195</td>
<td>% 10.945</td>
</tr>
<tr>
<td>Surgical</td>
<td>120</td>
<td>16 (13)</td>
<td>121</td>
<td>15 (12) 0.828</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>71</td>
<td>4 (6)</td>
<td>74</td>
<td>5 (7.0) 1.000</td>
</tr>
<tr>
<td>Cognitive decline, n (%)</td>
<td>134</td>
<td>20 (15)</td>
<td>153</td>
<td>18 (12) 0.431</td>
</tr>
<tr>
<td>Surgical</td>
<td>84</td>
<td>16 (19)</td>
<td>96</td>
<td>13 (14) 0.316</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>50</td>
<td>4 (8)</td>
<td>57</td>
<td>5 (9) 1.000</td>
</tr>
<tr>
<td>Physical decline, n (%)</td>
<td>134</td>
<td>50 (37)</td>
<td>150</td>
<td>71 (47) 0.088</td>
</tr>
<tr>
<td>Surgical</td>
<td>80</td>
<td>33 (41)</td>
<td>98</td>
<td>60 (61) 0.008</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>54</td>
<td>17 (32)</td>
<td>52</td>
<td>11 (21) 0.228</td>
</tr>
</tbody>
</table>

|                          | N                        | mean ± SD       | N    | mean ± SD  |
| ADL mean difference      |                          |                 |      |            |
| vs discharge             |                          |                 |      |            |
| 2 weeks before admission | 134                     | -3.8 ± 8.6      | 150  | -5.6 ± 9.1 | 0.074 |
| • Surgical               | 80                      | -5.5 ± 9.1      | 98   | -8.2 ± 9.4 | 0.020 |
| • Internal medicine      | 54                      | -1.4 ± 7.2      | 52   | -0.7 ± 5.9 | 0.499 |
| vs 3 months after        |                          |                 |      |            |
| discharge                | 117                     | 0.5 ± 5.9       | 124  | -0.7 ± 5.1 | 0.517 |
| • Surgical               | 78                      | 0.0 ± 4.9       | 87   | -0.4 ± 4.7 | 0.650 |
| • Internal medicine      | 39                      | 1.3 ± 7.6       | 37   | -1.3 ± 6.1 | 0.528 |
| Discharge vs 3 months    |                          |                 |      |            |
| after discharge          | 97                      | 3.2 ± 7.3       | 118  | 5.7 ± 8.8  | 0.058 |
| • Surgical               | 62                      | 4.5 ± 7.9       | 81   | 7.7 ± 9.5  | 0.035 |
| • Internal medicine      | 35                      | 0.9 ± 5.5       | 37   | 1.4 ± 4.4  | 0.955 |

|                          | N                        | n               | n    | P  |
| Readmission <1 month, n (%) | 191                     | 21 (11)         | 195  | 29 (15) 0.240 |
| Surgical                 | 120                     | 13 (11)         | 121  | 17 (14) 0.464 |
| Internal medicine        | 71                      | 8 (11)          | 74   | 12 (17) 0.334 |
| Of which unplanned, n (%) | 21                      | 13 (62)         | 29   | 21 (72) 0.432 |
| Surgical                 | 13                      | 8 (62)          | 17   | 11 (65) 1.000 |
| Internal medicine        | 8                       | 5 (63)          | 12   | 10 (83) 0.347 |
Chapter 7

Subgroup analyses
The incidence of hospital-acquired delirium and functional decline was the highest among the surgical patients, although there was no statistically significant difference between the pre-CWH and post-CWH groups, see Table 3. With respect to the secondary outcome measures for the surgical patients, ADL improved significantly between the time of discharge and three months after discharge. Burden of care among informal caregivers decreased for the surgical patients.

Discussion
The CareWell in Hospital (CWH) program, which was designed to adapt hospital care to meet the needs of frail elderly patients, was satisfactorily implemented in two surgical departments and one general medicine department. Our before-after analysis revealed no effects on hospital-acquired delirium or functional decline during hospital admission yet. Functioning from discharge to three months after discharge improved, which was statistically significant among surgical patients, and was in line with reduced burden of care among informal caregivers from over time of admission to three months after discharge. However, before interpreting these results, the strengths and limitations of the study will be discussed.

Table 3 Continued

<table>
<thead>
<tr>
<th></th>
<th>Pre-CWH (n=191)</th>
<th></th>
<th>Post-CWH (n=195)</th>
<th></th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>mean</td>
<td>SD</td>
<td>N</td>
<td>mean</td>
</tr>
<tr>
<td>Caregiver self-rated burden of care, mean difference ± SD</td>
<td>31</td>
<td>0.5</td>
<td>2.8</td>
<td>39</td>
<td>-0.6</td>
</tr>
<tr>
<td>Surgical</td>
<td>19</td>
<td>0.3</td>
<td>3.1</td>
<td>26</td>
<td>-0.9</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>12</td>
<td>0.9</td>
<td>2.4</td>
<td>13</td>
<td>1.2</td>
</tr>
</tbody>
</table>

* Primary outcome measures: Delirium incidence was measured using the Confusion Assessment Method (CAM). Cognitive decline represents a decline of 2 or more points on the Mini-Mental State Examination (MMSE) between admission and discharge. Physical decline represents a decline of 3 or more points on the 11 ADL questions between two weeks before admission and discharge, using the Groningen Activity Restriction Scale with 4 answer categories (GARS-4).
† Secondary outcome measures: ADL is measured with the Groningen Activity Restriction Scale, which contains eleven questions with four answer categories (GARS-4), with a range of 11 to 44. Readmission is defined as a readmission within one month of discharge in the intervention hospital. Self-rated Burden of Care among informal caregivers is a 0-10 scale.
Strengths and limitations

Our study investigated the implementation of an integrated multi-component care model for frail elderly patients and included both professional and volunteer-guided prevention activities, which is an extremely innovative approach particularly among surgical departments. This approach included care provision that is targeted to the patient’s individual needs, a notion that is becoming increasingly relevant and is an important strength of our intervention study. Nevertheless, because the aim of the approach is to achieve a major transition to a geriatrics team approach in surgical and non-surgical healthcare, our study was constrained by several limitations.

First, the before-after study design is generally considered to be less stringent than randomized controlled trials, as confounding factors may not be distributed equally among the subjects, and certain differences can arise between the measurements that can influence the effects of the intervention. Indeed, in our study, relevant differences in the study population—such as a higher co-morbidity rate and higher ASA scores in our intervention group—may have resulted in an underestimation of the potential net benefit of CWH. Similarly, interruptions in the implementation process (due to moving the two surgical departments to a new building) may have lessened the effect of the intervention. However, the study design is not a limitation per se, as our study of this complex intervention was designed to be a pragmatic trial in the real world, testing the intervention’s effectiveness and implementation potential over the long run, including changes in—and adaptation to—a dynamic healthcare organization, thereby increasing external validity.

Second, during the post-CWH measurements, although all of the patients were screened as in the first part of the intervention, only 32% of the patients who were included in the analyses were frail and therefore received (parts of) CWH, and this likely decreased our power to detect the effects of CWH. Due to our pragmatic study (in which we were dependent on a fixed time period and the clinical frailty judgments of professionals), the number and percentage of frail patients could not be predicted prospectively or matched retrospectively.

Third, the daily monitoring of delirium by the research physician during the pre-implementation period may have been an intervention (i.e., delirium prevention) in itself due to the orienting and comforting nature of the interviews. This ‘intervention’ may have limited the contrast detected by our study. In addition, because a geriatric consultation team (GCT) was available upon request before the start of CWH, the departments were accustomed to the concept of a GCT, which may have contributed to the rather unexpected low incidence of hospital-acquired delirium.

Fourth, CWH was implemented in only one hospital and, although this was a pragmatic trial, this limits the external generalization of the results. In the future, our results will need to be related to findings regarding the implementation of the CWH program or a (modified) HELP program elsewhere within the Netherlands. Indeed,
such a program was initiated in the fall of 2012 (http://www.trialregister.nl/trialreg/admin/rctview.asp?TC=3842).

Finally, because our CWH intervention is a service provided to non-geriatric departments, benefits can be realized only when all of the medical specialists and nurses share the responsibility for care and act together to achieve their goals. The ability of the key players to implement and adhere to the recommendations of the program will determine the success of “shared care” and its ultimate effect on patient outcome.\textsuperscript{32-34} However, because compliance with such a program can vary widely in practice, we performed a mixed-methods process evaluation, combining both qualitative and quantitative measures during implementation of the CWH, of which we feel it is a major strength and innovative part of our study in order to explain results. This evaluation revealed that implementation of the CWH is ongoing both during and after the post-CWH measurement period. For example, an activating lunch program in which patients have lunch together in a common room was initiated after the start of the measurements (i.e., May 2012). Other examples include the expanding responsibilities of department nurses during implementation of the program, and the incorporation of a module regarding elderly care into an education program for new nurses twelve months after the start of the implementation. In addition, adherence to CWH continues to receive attention and effort, e.g. screening percentages still increased (61 % in September 2011, 71% in January 2012, and 76% in May 2012). Adherence to the various CWH-recommendations by nurses ranged from 46% to 100%, trained volunteers performed 46% of the intended visits and the quality of their visits improved. Thus, although many interventions were implemented satisfactorily, our study period for the development, piloting, implementation, and evaluation of a complex intervention such as CWH was insufficient for complete integration or to detect the full effects of the program. The cause of this is often seen from evaluating innovative interventions in surgical departments and is known as the “learning curve”\textsuperscript{31}, which also is an essential part of transition experiments\textsuperscript{35}. Nevertheless, because the intervention received a positive evaluation by most professionals, we have since introduced the CWH program to two additional departments (orthopedics and cardiology). We call for ongoing monitoring of processes and outcome, which is needed for transition experiments such as CWH, and the use of uniform measures of implementation degree to facilitate the continuous monitoring and interpretation of its effects.\textsuperscript{36} In addition, regarding outcome measures, Payne et al. suggest to look – in addition to common health-related measures – at other patient benefits and to incorporate non-health-related outcome measures also, such as meeting expectations, satisfaction with services, perceived personal control, decision-making, etc.\textsuperscript{37} For peri-operative outcomes research in elderly patients, Peden and Grocott also suggest the use of patient reported outcome measures (PROMs) or patient reported experiences measures (PREMs) next to traditional outcome
measures. During the CWH study, such a measure was actually developed. As this measure still had to be validated, and no other non-health-related or non-disease-related PROMs/PREMs for frail elderly patients were available at the start of the study, we could not yet report such an outcome here. Measures on satisfaction with care were also collected during a well-performed pragmatic study of Goldberg and colleagues concerning a specialist medical and mental health unit for elderly patients with cognitive impairment or delirium. They also did not find effects on primary health-related outcomes, however positive differences on experiences and satisfaction with care were in fact shown. Patient-reported outcomes may be more appropriate measures in determining quality and safety of care for frail persons, for whom improving health might not be the main concern as well as not always a realistic goal.

**Literature delirium incidence**

Although parts of—and the complete—HELP program have shown to be effective in both geriatric and general medicine departments with relatively high hospital-acquired delirium incidences, surgical departments with a low baseline hospital-acquired delirium incidence were principally represented in our study. Therefore, detecting changes due to our highly complex and comprehensive intervention during the one-year implementation period was particularly challenging. The original HELP study revealed an effect on hospital-acquired delirium: in general medicine departments, the incidence of delirium was 15.0% in the control group and 9.9% in the intervention group. In our study, because the baseline incidence of hospital-acquired delirium in the pre-CWH group was 11%, achieving an even further decrease was difficult. In Australia, a modified HELP study revealed a reduction in the incidence of hospital-acquired delirium from 38% to 6%, although the study focused only on the trained volunteers part of HELP and was performed in a geriatric department. In Europe, the results of one adapted HELP study have been published and revealed a higher baseline hospital-acquired delirium incidence: the incidence in the pre-intervention group was 23%, and the incidence in the post-intervention group was 12%; the incidence in the control group was 19%. However, this study was performed in only one geriatric department (the intervention groups) and two internal medicine departments (the control group) and did not include surgical departments or volunteers.

In addition, compared to departments in other Dutch hospitals, the baseline hospital-acquired delirium incidence in our study was relatively low, despite the use of a careful and standardized procedure for assessing delirium. Other Dutch studies reported delirium incidences of 30-31% among patients age ≥70 years undergoing cardiac surgery, 23% among patients age ≥65 years undergoing vascular surgery in a surgical department with high standard delirium care, and prevalent delirium among 19% of the patients age ≥65 years in general internal medicine.
departments\textsuperscript{45} compared to our baseline prevalence of 5\% in the general internal medicine department. Although the Dutch quality of care is known for its high standard\textsuperscript{46}, the incidence of hospital-acquired delirium varies between hospitals and between surgical departments. This variability underscores the importance of the preventive and integrated or shared care that can be provided by a CWH program.

**Conclusions**

In this study, we evaluated the innovative CareWell in Hospital (CWH) program, which uses a proactive shared-care geriatric CareWell intervention team combined with the help of trained volunteers in order to support non-geriatric physicians and nurses to prevent hospital-acquired delirium and ADL decline during hospital admission. Implementation was satisfactory but CWH was not fully integrated yet, as the care processes for frail elderly patients positively changed but changes were ongoing. CWH was not yet able to show a beneficial effect with respect to the incidence of hospital-acquired delirium and ADL and cognitive decline during hospital admission overall, and this is likely due to the low overall baseline delirium incidence, relatively high ASA score, and high co-morbidity rates in the intervention group, as well as the timing of the post-implementation evaluation during the ongoing learning curve for professionals. Nevertheless, especially among surgical patients cognitive functioning at discharge was improved, ADL functioning improved significantly, and informal caregivers reported a lower burden of care three months after discharge. Therefore, the CWH program may be a valuable intervention for surgical departments to prevent commonly experienced complications among their increasing numbers of frail elderly patients. To measure the maximum effects of this program in future as well as in other hospital settings, a longer period of implementation and monitoring is needed, as well as the use of innovative patient reported outcome/experience measures in addition to commonly used health-related or disease-related outcome measures.
References

6. Covinsky KE, Pierluissi E, Johnston C. Hospitalization-associated disability: “she was probably able to ambulate, but I’m not sure”. JAMA 2011 October;26:306(16):1782-1793.
### APPENDIX A  The intervention components of the CareWell in Hospital program

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>First screening by nurses</td>
<td>A nurse judges a patient to be potentially frail when the patient is at risk of delirium, malnutrition, physical decline and/or falling, on/before the day of admission. The used instrument is obliged to be used by all Dutch hospitals for all patients age ≥70 years and therefore chosen as an appropriate screening instrument to integrate with usual care.</td>
</tr>
<tr>
<td>Second screening by geriatrics nurse</td>
<td>Clinical judgment of frailty by a geriatrics nurse, based on the nursing and medical file (including medication) and a brief interview with the patient. To create an uniform procedure which is feasible and efficient in practice, the way in which the clinical judgments are made are discussed during the monthly meetings with the intervention team.</td>
</tr>
<tr>
<td>Medication review</td>
<td>The geriatrician (or resident) critically evaluates: medical information and medication use obtained from the medical file; if possible, information regarding the use of medications by the patient prior to admission; information from the primary care physician when the indication for a medication is unclear. The evaluation of medication is performed by following pre-set steps and criteria.</td>
</tr>
<tr>
<td>CareWell plan</td>
<td>Contains recommendations about care and well-being provided by the CareWell team, communicated both verbally and written, to which nurses and physicians should adhere and are responsible. These recommendations regarding health, well-being, support from trained volunteers, medication, after-care and goal-attainment are categorized under the following headings: somatic problems, physical functioning, social environment, psychosocial functioning, and communication. Recommendations follow findings from a conducted interview with the patient by a geriatrics nurse, partially based on the EasyCare method.</td>
</tr>
<tr>
<td>Follow-up during admission and update of the CareWell plan upon discharge</td>
<td>Follow-up comprises checking for adherence and evaluating the recommendations of the CareWell team, from nursing files and multidisciplinary meetings. Update of the CareWell plan one day prior to discharge consists of the formulation of geriatric information to be added to the discharge letter to the primary care physician.</td>
</tr>
<tr>
<td>Medical history by proxy</td>
<td>An interview conducted with a close relative of the patient or another care professional in order to obtain information regarding the patient’s health situation when additional and/or reliable is needed.</td>
</tr>
<tr>
<td>Comprehensive geriatric assessment</td>
<td>An extensive multidisciplinary clinical geriatric assessment that is used to create a coordinated and integrated care plan for an individual highly frail patient, performed by a geriatrician (or resident).</td>
</tr>
<tr>
<td>Multidisciplinary meeting</td>
<td>A weekly meeting within the department with geriatric input, in which several care professionals are involved—including the geriatrics nurse and geriatrician—in order to adjust the medical and nursing policies to the individual needs and wishes of a frail elderly patient.</td>
</tr>
</tbody>
</table>
## APPENDIX A  Continued

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulation of cognitive and physical activities by trained volunteers</td>
<td>CWH volunteers work on the basis of an instruction protocol, as part of the CareWell plan, which: contains concise information regarding (approaching) the patient and the four programs orientation, therapeutic activities, physical activities and nutrition; is indicated by a geriatrics nurse; is created daily and adapted whenever necessary by a CWH volunteers coordinator; and is to be followed twice daily on weekdays and once daily during the weekend.</td>
</tr>
<tr>
<td>Education of nurses and physicians</td>
<td>The geriatrics team provides educational sessions on group level on all abovementioned intervention parts as well as continuous coaching-on-the-job.</td>
</tr>
</tbody>
</table>
CHAPTER 8

Valuing post-discharge healthcare consumption data as outcomes

Submitted:
FC Bakker, EM Adang, A Persoon, MGM Olde Rikkert.
Valuing follow-up data on healthcare consumption among frail elderly inpatients.
Abstract

**Objective:** The aim of this article is to reflect on the method of the CareWell in Hospital program – aimed at improving hospital-wide care for (frail) elderly inpatients – to collect and use data regarding the use of healthcare services by (frail) elderly patients within three months after discharge from hospital.

**Design:** Observational study.

**Setting:** Two surgical and one internal medicine department in a Dutch university hospital.

**Participants:** 385 inpatients age 70 years and older.

**Measurements:** Data on use of healthcare resources was gathered by using the self-reported TOPICS-MDS questionnaire at three months after discharge from hospital. The used prices per unit of the used variables were based on the Dutch guidelines for economic evaluation in healthcare. A frailty index was calculated from TOPICS-MDS to measure the association between cost parameters and frailty.

**Results:** In total, 270 T3 questionnaires were returned (70.1%), of which 202 patients had complete data on use of healthcare services (74.8%) and were included in analyses. 90% of the costs related to use of healthcare services within three months after discharge from hospital is associated with hospital care (48.8%), homecare (26.6%) and institutionalization (14.6%). A higher frailty index at discharge from hospital is significantly associated with higher home care, physiotherapy and total costs within three months after discharge.

**Conclusions:** When using data on post-discharge healthcare consumption among (frail) elderly patients for outcome measures, researchers should (1) prioritize data collection to main cost-drivers such as hospital (re)admissions, institutionalization and homecare (preferably not self-reported data), (2) monitor frailty as a continuous outcome and effect modifier, not only for medical and functional performance outcomes, but also for costs following admission.
Introduction

The Dutch National Care for the Elderly Program (NCEP: 2008 – ongoing) was designed to improve the care for elderly people with complex care needs throughout the Netherlands. The NCEP stimulates the development of coherent care that incorporates elderly persons’ preferences and needs throughout the care system. This should result in the maintenance of independence and a equal or decreased need of healthcare services.

One of the more than sixty projects is the CareWell in Hospital (CWH) program, a complex multi-component intervention with the aim to change hospital care for (frail) elderly patients towards a proactive practice concerning prevention of delirium and functional decline, maintaining autonomy and integration of wellbeing aspects into acute care. Besides the performance of a pilot study and an effectiveness study including process evaluation, a cost evaluation was to be conducted.

Hospital-wide interventions like CWH which are based on the Hospital Elder Life Program (HELP) have shown to be cost-effective or cost-saving before, although the extent, quality and scope of the economic evaluation varies. These studies mainly included hospital costs, costs associated with decreased delirium episodes, length of stay, potential increased revenue and/or intervention costs. Performing economic evaluations including use of healthcare services after hospital discharge seems uncommon. However, it is important when looking at improvements throughout the care system to include a broader perspective in economic evaluations rather than the perspective of one healthcare provider such as the hospital, from which the patient receives care during only a short period of time.

In addition, targeting interventions to groups with high-risk of adverse events or use of health and social services is becoming more important in the face of efficient use of resources. Several screening instruments and frailty measures have shown that higher risk or frailty scores are associated with higher costs related to health and social services use. However, although use of frailty measures may guide healthcare professionals in addressing interventions for intervening with frailty, such scores may not be used as predictors in clinical decision-making yet.

To facilitate cost evaluation (from societal perspective), as well as to compare the outcomes between all national NCEP projects, the Older Persons and Informal Caregivers Survey Minimum Dataset (TOPICS-MDS) was developed. TOPICS-MDS was compulsory to administer to all NCEP study participants and consists of questions and validated instruments regarding demographics, quality of life, morbidity, functional (dis)abilities, mental health, social functioning, and use of healthcare services. Depending on the setting and intervention, specific variables may be added for complete (cost-) effectiveness analyses, as we did in the CWH study. In addition, a frailty index, which has been validated, can be calculated from TOPIC-MDS.
However, it was not yet known what amount and quality of data concerning use of healthcare services the TOPICS-MDS yields and how they can be used in economic evaluation. In addition, as the NCEP focuses on frail elderly people in particular, the role of frailty in characterizing healthcare utilization is of interest. Therefore, the aim of this article is to reflect on the method of the CWH program to collect and use data regarding the use of healthcare services by elderly patients aged 70 years and older, both frail and in general, within the three months after discharge.

Methods

Study design, setting & participants
The CWH program was developed as a complex multi-component intervention for hospitalized patients aged 70 years and older, starting with screening for frailty, followed by several tailored interventions by a proactive CareWell team and trained volunteers for the frail patients. Details are described elsewhere. The CWH program was evaluated in a before-after study, which was performed in two surgical departments and one internal medicine department at Radboud university medical center, Nijmegen, The Netherlands. Overall, no significant differences in primary endpoints were found. Mean Activities of Daily Living (ADL) between discharge and follow-up improved. Caregivers rated burden of care lower at three months post-discharge. Recruitment and data collection for the effect study occurred three months per department: from January 2011 until April 2011 (pre-implementation) and from March 2012 until July 2012 (post-implementation). The initial inclusion criteria included patients age 70 years and older who were admitted to the hospital for longer than 48 hours. Patients who did not understand Dutch, were admitted less than 48 hours, had a contagious disease, were terminally ill, and/or were treated by a medical specialist from another department were excluded from the trial.

Outcome measures & data collection
Economic evaluation was based on the data gathered by using the TOPICS-MDS (The Older Persons and Informal Caregivers Survey Minimum DataSet). TOPICS-MDS includes – among other variables – questions regarding the use of healthcare services during previous months (volume). These healthcare services include hospital admission, visits to a general practitioner, use of homecare services, admission to a home of the aged or a nursing home, and the use of daycare services. Hospital admission was categorized as a visit to an outpatient clinic, daycare or hospital stay for at least one night. Visits to a general practitioner were categorized as visits within normal working hours and visits during evenings, nights or weekends. Use of homecare services was categorized as nursing care and domestic care. An additional variable, the number of visits to (para)medical professionals (e.g. physio-
therapist), was added to TOPICS-MDS. TOPICS-MDS was administered to patients who were included in the CWH study, upon discharge by interview with the patient which was conducted by a research assistant (T0) and three months after their discharge from hospital by written self-report (T3). For this article, data of T3 of both measurement periods (before-after) is used. The used prices per unit of resource consumption were based on the Dutch guidelines for economic evaluation in healthcare.¹⁶ A research assistant checked all data for accuracy and completeness.

**Data analysis**

Data were analyzed using the statistical software program SPSS version 22.0.

**Population characteristics**

Baseline characteristics of the total study population were analyzed using descriptive statistics. These baseline characteristics included age, gender, surgical or non-surgical patient, co-morbidity using the Cumulative Illness Rating Scale – Geriatrics (CIRS-G) ranging from 0-56 with a higher score indicating more (severe) illnesses¹⁷, cognitive functioning by administering the Dutch version of the Mini-Mental State Examination (MMSE)¹⁸, continuous frailty index calculated from TOPICS-MDS, admission type, living situation, discharge destination and readmission. Baseline characteristics of the pre- and post-CWH implementation groups were compared by the Student’s t-test for continuous data that were normally distributed; the Mann-Whitney U test was used for data that were not normally distributed. The Chi-square test was used to compare categorical data. Differences were considered to be statistically significant if \( p<0.05 \) (for two-tailed tests).

**Cost data**

Descriptive statistics were used to describe the average costs per cost parameter related to health care consumption for the whole study population, as well as for the pre- and post-CWH implementation groups (data not shown as no statistical significant differences between pre- and post-implementation costs were found (for mean total costs, bootstrapped Student’s t-test: \( p=0.264 \)). Costs analyses were performed on patients who had complete costs data on T3.

**Frailty index and costs**

A frailty index was calculated from the TOPICS-MDS by calculating the sum of deficits observed in a study participant divided by the total number of possible deficits derived from TOPICS-MDS¹⁴, in order to value costs considering the association between cost parameters and frailty. Bootstrapped linear regression analyses were performed to determine the association between the continuous frailty index at discharge and costs related to use of healthcare resources within three months after discharge.
Ethics
This study was approved by the medical center’s Dutch Research Ethics Review Committee. Written informed consent was judged as unnecessary for this study, as CWH was considered a quality improvement project and not a medical experiment. Each participant provided verbal consent. The study was registered at www.clinicaltrials.gov (NCT01273116).

Results

Population characteristics
Data of 190 patients before and of 195 patients after implementation of the CWH program were included in costs-analyses. In total, 270 T3 questionnaires were returned (70.1%). Table 1 presents characteristics of respondents who returned the questionnaire. Patients of whom questionnaires were returned post-implementation of CWH had a significantly higher CIRS-G score than patients pre-implementation, and had less questionnaires with complete data.

Patients who did not return the T3 questionnaire were significantly older, frailer, had more co-morbidity (CIRS-G), lower scores on cognitive functioning (MMSE), and were significantly more often non-surgical patients than those who did return the T3 questionnaire (see E-Table 1).

In total, of the patients who returned the questionnaire, 202 patients had complete data on use of healthcare services (74.8%). Patients who did not have complete data on all cost variables were significantly older, more often female, had lower MMSE scores, higher frailty index scores at discharge and lived more often in a care facility than patients who did have complete data on use of healthcare services (see E-Table 2).

Cost data
Data from T3 questionnaires on use of healthcare services is presented in Table 2. When calculating the absolute proportion of the mean costs per parameter and the mean total costs, 90% of the costs related to use of healthcare services within three months after discharge from hospital is associated with hospital care (48.8%), homecare (26.6%) and institutionalization (14.6%).

Frailty and costs
For 186 cases, a frailty index could be calculated. A higher frailty index at discharge from hospital is significantly associated with higher total costs within three months after discharge ($R^2=0.090$). The same accounts for visits to the primary care physician during working hours, home care and use of physiotherapy. See Table 3.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Pre-implementation CWH</th>
<th>Post-implementation CWH</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS T3, n (%)</td>
<td>270 (100%)</td>
<td>132 (89.9%)</td>
<td>138 (99.3%)</td>
<td>0.781</td>
</tr>
<tr>
<td>MDS T3 complete costs data</td>
<td>270 (74.8%)</td>
<td>132 (81.8%)</td>
<td>138 (68.1%)</td>
<td>0.010</td>
</tr>
<tr>
<td>Age at admission, years ± SD</td>
<td>270 (76.6 ± 5.2)</td>
<td>132 (77.0 ± 4.9)</td>
<td>138 (76.3 ± 5.3)</td>
<td>0.100</td>
</tr>
<tr>
<td>Gender, male (%)</td>
<td>270 (58.9%)</td>
<td>132 (59.8%)</td>
<td>138 (58.0%)</td>
<td>0.754</td>
</tr>
<tr>
<td>Surgical patient, n (%)</td>
<td>270 (66.3%)</td>
<td>132 (65.2%)</td>
<td>138 (67.4%)</td>
<td>0.697</td>
</tr>
<tr>
<td>CIRS-G, total score ± SD</td>
<td>270 (12.5 ± 4.8)</td>
<td>132 (11.6 ± 4.1)</td>
<td>138 (13.3 ± 5.2)</td>
<td>0.048</td>
</tr>
<tr>
<td>MMSE admission, score ± SD</td>
<td>264 (27.0 ± 3.3)</td>
<td>126 (26.8 ± 3.2)</td>
<td>138 (27.1 ± 3.4)</td>
<td>0.088</td>
</tr>
<tr>
<td>MMSE discharge, score ± SD</td>
<td>217 (27.4 ± 3.2)</td>
<td>99 (27.2 ± 3.1)</td>
<td>118 (27.6 ± 3.2)</td>
<td>0.098</td>
</tr>
<tr>
<td>Frailty index discharge, score ± SD</td>
<td>248 (0.23 ± 0.13)</td>
<td>118 (0.22 ± 0.13)</td>
<td>130 (0.24 ± 0.13)</td>
<td>0.415</td>
</tr>
<tr>
<td>Admission type, n (%)</td>
<td>270</td>
<td>132</td>
<td>138</td>
<td>0.434</td>
</tr>
<tr>
<td>- Emergency</td>
<td>70 (25.9%)</td>
<td>32 (24.2%)</td>
<td>38 (27.5%)</td>
<td></td>
</tr>
<tr>
<td>- Elective</td>
<td>149 (55.2%)</td>
<td>78 (59.1%)</td>
<td>71 (51.4%)</td>
<td></td>
</tr>
<tr>
<td>- From other department/hospital</td>
<td>51 (18.9%)</td>
<td>22 (16.7%)</td>
<td>29 (21.0%)</td>
<td></td>
</tr>
<tr>
<td>Living situation, n (%)</td>
<td>269</td>
<td>132</td>
<td>137</td>
<td>0.687</td>
</tr>
<tr>
<td>- Independent, alone</td>
<td>70 (26.0%)</td>
<td>37 (28.0%)</td>
<td>33 (24.1%)</td>
<td></td>
</tr>
<tr>
<td>- Independent together</td>
<td>186 (69.1%)</td>
<td>88 (66.7%)</td>
<td>98 (71.5%)</td>
<td></td>
</tr>
<tr>
<td>- Care facility</td>
<td>13 (4.8%)</td>
<td>7 (5.3%)</td>
<td>6 (4.4%)</td>
<td></td>
</tr>
<tr>
<td>Discharge destination, n (%)</td>
<td>270</td>
<td>132</td>
<td>138</td>
<td>0.939</td>
</tr>
<tr>
<td>- Home</td>
<td>181 (67.0%)</td>
<td>88 (66.7%)</td>
<td>93 (67.4%)</td>
<td></td>
</tr>
<tr>
<td>- Other hospital</td>
<td>74 (27.4%)</td>
<td>36 (27.3%)</td>
<td>38 (27.5%)</td>
<td></td>
</tr>
<tr>
<td>- Care facility</td>
<td>15 (5.6%)</td>
<td>8 (6.1%)</td>
<td>7 (5.1%)</td>
<td></td>
</tr>
<tr>
<td>Readmission &lt;1 mo, n (%)</td>
<td>270</td>
<td>132</td>
<td>138</td>
<td>0.383</td>
</tr>
</tbody>
</table>

* MDS = Older Persons and Informal Caregivers Survey Minimum DataSet. CIRS-G = Cumulative Illness Rating Scale – Geriatrics, total score range 0-56, 0-14 categories. MMSE = Mini-Mental State Examination (range 0-30).
Table 2 Costs related to self-reported use of healthcare services within three months after discharge from hospital, based on complete data T3 (N=202)

<table>
<thead>
<tr>
<th>Service</th>
<th>Mean costs total population ± SD</th>
<th>Number of patients who used the services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Outpatient clinic</td>
<td>197 ± 319</td>
<td>0-1930</td>
</tr>
<tr>
<td>- Daycare</td>
<td>115 ± 663</td>
<td>0-7742</td>
</tr>
<tr>
<td>- Admission</td>
<td>1438 ± 3584</td>
<td>0-22725</td>
</tr>
<tr>
<td><strong>Primary care physician:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- During working hours</td>
<td>64 ± 97</td>
<td>0-840</td>
</tr>
<tr>
<td>- Out of hours</td>
<td>8 ± 25</td>
<td>0-172</td>
</tr>
<tr>
<td><strong>(Para)medics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Physiotherapist</td>
<td>204 ± 325</td>
<td>0-2340</td>
</tr>
<tr>
<td>- Occupational therapist</td>
<td>3 ± 21</td>
<td>0-220</td>
</tr>
<tr>
<td>- Speech therapist</td>
<td>0 ± 3</td>
<td>0-33</td>
</tr>
<tr>
<td>- Dietician</td>
<td>9 ± 28</td>
<td>0-162</td>
</tr>
<tr>
<td>- Psychiatrist</td>
<td>1 ± 7</td>
<td>0-103</td>
</tr>
<tr>
<td>- Psychologist</td>
<td>8 ± 52</td>
<td>0-560</td>
</tr>
<tr>
<td>- Psychiatric community nurse</td>
<td>2 ± 14</td>
<td>0-146</td>
</tr>
<tr>
<td>- Social work</td>
<td>7 ± 34</td>
<td>0-260</td>
</tr>
<tr>
<td><strong>Home care:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Nursing care</td>
<td>665 ± 1607</td>
<td>0-12045</td>
</tr>
<tr>
<td>- Domestic care</td>
<td>287 ± 580</td>
<td>0-3120</td>
</tr>
<tr>
<td><strong>Temporary institutionalization:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Home for the aged</td>
<td>212 ± 940</td>
<td>0-7560</td>
</tr>
<tr>
<td>- Nursing home</td>
<td>313 ± 1920</td>
<td>0-16660</td>
</tr>
<tr>
<td><strong>Day care</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Day treatment</td>
<td>35 ± 200</td>
<td>0-1170</td>
</tr>
<tr>
<td>- Day treatment</td>
<td>14 ± 148</td>
<td>0-1755</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>3582 ± 5410</td>
<td>0-32844</td>
</tr>
</tbody>
</table>

* 1 € ≈ 1.35 US$
Discussion

Our aim was to reflect on the methods of the CWH program to collect and use data regarding the use of healthcare services by elderly patients aged 70 years and older within the three months after discharge and the association with frailty. From data of post-discharge use of healthcare services among elderly patients included in the CareWell in Hospital study we found that (1) hospitalization, institutionalization and homecare were the major cost-drivers, as they account for 90% of the costs made,
(2) frailty index score at discharge showed a low but significant positive association with total costs, visits to a primary care physician during working hours, use of physiotherapy and use of homecare within the three months after discharge, and (3) the most frail population is most likely to drop out of data collection or data analyses. These findings may have had several implications for this research and practice.

Implications

Setting priorities for data collection

Gathering all data on post-discharge health services use has been complicated and time-consuming. Due to privacy restrictions data had to be collected through self-reported questionnaires. The response was relatively high (70%), probably due to the daily personal contacts during hospital admission and reminder phone calls, however, still 25% of the respondents who returned the questionnaire were excluded from our analyses. This may have been due to missing data on variables that do not importantly influence total costs. So when looking at effects of interventions which affect the number of hospital admissions, monitoring at least hospital admission as the main cost-driver – although it provides an inexact estimate – may be sufficient to draw fairly robust conclusions about total costs as it influences the total costs most heavily. The hospitalization data is easily available from hospital or health insurance databases and thereby provide a more complete insight in actual use of resources. In this, it may also overcome challenges such as the exclusion/missingness of data from frail and less healthier patients, especially when this is dependent on self-report, as in our study.\textsuperscript{19}

Preventing hospital (re)admissions

When the goal of a study is to reduce use of healthcare resources, focusing on interventions to prevent hospital (re)admissions may be most effective, e.g. focusing on delivery of care during the transition from hospital to home, as also concluded by Vashi and colleagues.\textsuperscript{20} However, they focused on Emergency Department (ED) visits after discharge next to acute hospital admissions while in the Netherlands ED’s are less accessible due to the gate-keeper function of the (less costly) general practitioner (GP). In our CWH study we did aim to improve care transitions from hospital to home, and we did see a (non-significant) reduction in use of GP, however the impact of reduction of GP visits on total costs is only little. Consequently, we may need to look at other or more intensive interventions to prevent hospital (re)admissions. For example, it would be helpful to distinguish patients with a high risk for (re) admissions. Within our data we looked at an association between the frailty index at discharge and hospital admission within three months after discharge. We saw a small but significant association in the pre-CWH group, but not in the post-CWH or overall patient group. This may statistical power related. However, when dealing with
high costs as in elderly care, relatively small associations may be relevant when talking about higher absolute costs. Associations between frailty (at admission) and readmission are found in other studies, but the predictive properties seem to be poor.\textsuperscript{21,22} It is not clear whether or not intervening with frailty itself could potentially reduce hospital (re)admissions.

On the contrary, (re)admissions may not always be preventable for frail elderly people with a deteriorating health condition anyhow. Readmissions may not be a failure of the healthcare system as Reuben and Tinetti postulate, but frail elderly people may in fact become hospital-dependent due to the advanced acute care interventions to increase survival.\textsuperscript{23} A more explicit focus on preferences and goals of care and thereby focusing on quality of life instead of prolonging life may be more effective in realizing a reduction in healthcare consumption. Especially when the frailty process of an elderly patient does not seem to be reversible, attention to coping with the frailty processes and insight into specific events that result in a (re)admission might be helpful in organizing effective and efficient patient care, similar to e.g. palliative care\textsuperscript{24}.

**Calculating hospital costs**

As data collection was based on self-report and calculation was based on standardized costs, we may need to consider the validity of our method of calculating hospital costs for a frail elderly patient population. The price of a hospital admission day as proposed in the national guideline for cost evaluation is calculated based on mean costs associated with a hospital admission in the general population (€505).\textsuperscript{16} However, actual costs are different per patient group and medical specialty. Frail elderly patients may for example use more nursing care than expensive innovative and medical technology that are included in the standardized mean costs. We calculated that the mean total costs of the CWH intervention per frail elderly patient per admission was approximately €500, which is a relatively cheap intervention compared to for example one MRI scan or a surgery in itself. Although our conclusions in this article would probably not change much, it would be valuable to perform more research in the actual costs related to hospital admission among frail elderly patients as absolute total costs and intervention effects may be over- or underestimated and/or influence healthcare decisions before-hand. It would also fit better in the trend of providing tailored care for a heterogeneous patient population than applying standardized methods and interventions. For example, we suggest to do more research in the effects of deciding not to use certain treatments after interventions like goal-setting as used in CWH (e.g. effect of geriatric evaluation on treatment decisions\textsuperscript{25}).
Conclusion
When collecting data on post-discharge healthcare consumption among frail elderly patients which are to be used as outcome measures, researchers should (1) prioritize data collection to main cost-drivers such as hospital (re)admissions, institutionalization and homecare (preferably not self-reported data), (2) monitor frailty as an outcome and effect modifier, not only for medical and functional performance outcomes, but also for costs following admission, (3) investigate the preventability and reasons of hospital (re)admissions for a frail elderly patient population when cost reduction is the main aim, and (4) critically reflect on or determine the theoretical and actual costs that are related to hospital (re)admissions among frail elderly patients.
Valuing post-discharge healthcare consumption data as outcomes

References


General discussion

*Partially based on:*
Introduction

In this thesis we have focused on how to optimize hospital-wide care for elderly patients from a cure, care and wellbeing perspective. In order to do so – and based on previous knowledge about this complex theme – we have developed, implemented and evaluated the CareWell in Hospital Program (CWH) with additional research instruments to measure patient experiences, nurses’ practices and implementation process characteristics. Although thoroughly developed and implemented, the evaluation did not show the effects on the primary outcomes regarding maintaining or improving functioning among frail elderly patients as anticipated. This made us search for explanations beyond the discussion points already addressed within the previous chapters. All the more as several Dutch programs – also including frailty assessment, comprehensive geriatric assessment and individualized care plans – within or outside the National Care for the Elderly Program are dealing with the same issue of not being able to show satisfying evidence or clinically relevant improvements on primary outcome measures whereas improvements are in fact perceived by several actors.\(^1^\)-6 We think the key issue may be that the programs are performed as transition experiments in real world, but that they are tried to be implemented and evaluated mainly following the scientific rules originating from randomized controlled trials (RCTs). We will explain this by using the example of our own program.

Transition experiment

The Dutch Ministry of Health, Welfare and Sport offered an opportunity to really experiment in reorganizing care for elderly persons with complex needs by funding so-called transition experiments within the National Care for the Elderly Program. Transition can be defined as a gradual, continuous process of change where the structural character of a complex system transforms.\(^7^\) In transition experiments a philosophy of learning-by-doing and doing-by-learning should be adopted. To what extent did we actually develop, implement and evaluate CWH as a transition experiment?

Development & Implementation CareWell in Hospital program

Before implementing CWH, a literature search for hospital-wide interventions which have already shown to improve care for elderly inpatients was performed (Chapter 1).\(^8^\) Many of such interventions include the performance of a comprehensive geriatric assessment (CGA), which is a basic principle in specialized geriatrics interventions. CGA is defined as a “multidimensional interdisciplinary diagnostic process focused on determining a frail elderly person’s medical, psychological and functional capability in order to develop a coordinated and integrated plan for treatment and long-term follow up”.\(^9^,^{10}\) It can be delivered either on geriatric hospital departments
with specialized staff or by specialized geriatrics teams across various hospital departments. For the first model, CGA has been proven to benefit frail elderly patients, but the benefit is less clear and controversial for geriatrics teams across departments.\textsuperscript{8,10-15} For both, a precondition for effectiveness is that CGA should be combined with management and intervention strategies, also referred to as Geriatric Evaluation and Management (GEM). The basic principles of CGA and the two general practices of providing this (departments and teams) are also represented in several other hospital-wide interventions to improve care for frail elderly hospitalized inpatients, e.g. Hospital Elder Life Program (HELP), which has served as a basis for development of the CWH including a wellbeing component provided by trained volunteers.\textsuperscript{8} Following several reviews, the success and effectiveness of CGA and following interventions is thought to be dependent on numerous factors:\textsuperscript{8-12,14}

- healthcare and financing system, e.g. no fragmentation and collaborative provision of follow-up services;
- high quality of coordination and continuity of care among healthcare professionals and institutions, e.g. follow-up and provision of rehabilitative services;
- availability of sufficient trained professionals, i.e. a well-functioning assessment team intensively involved in care processes;
- success of geriatrics projects in the past and the support of important actors (e.g. managers, board of directors, medical specialists);
- perceived sense of urgency and priority of geriatric medicine among hospital staff and the adoption of the geriatric care principles, e.g. modifying behaviors and adhering to interventions;
- quality of evidence gathered from the original proof of concept studies, e.g. sample size and study design;
- heterogeneity among patient populations, patient targeting, complexity of interventions, study settings and evaluation methods.

With regard to this wide range of factors, there is extremely much heterogeneity among the hospital interventions targeting at the frail elderly population – both in content, context, as in implementation processes – and there still is no clear evidence-based practice, though these services “form the very heart and soul of geriatrics” (Harvey J. Cohen\textsuperscript{16}). In fact, these issues make causal inferences in a real world setting extremely difficult. This causes problems in answering the who, what, where, when, why and how questions in hospital wide geriatrics management programs within daily hospital practice and its scientific evaluation.

Remarkably, from the studies included in the reviews it seems that the importance of these factors and questions have not changed much during the past decades. The search for how to improve hospital care for frail elderly patients across all departments in the continuously changing and modernizing hospital environment is still ongoing.
CGA improves diagnostic accuracy due to the comprehensive and multidisciplinary perspective of the evaluation and so its value is not particularly questioned by healthcare professionals, management staff and healthcare insurers. But the question arises why satisfying evidence for the benefits of interventions following e.g. CGA for elderly patients is hard to collect, still after performing all those seemingly well performed and intensive studies according to the accepted scientific standards.

CWH has tried to optimize implementation circumstances and the structure of the aimed transition by addressing such factors as mentioned above. An important viewpoint in this was the emphasis on pragmatic implementation, i.e. choices within the program and the implementation processes were based on what fitted current practices best in order to create sustainable practices (or: facilitating a transition in care). CWH was thus developed to fit into daily practice as well as implemented with a certain extent of flexibility in order to fit into practice next. In other words, we tried to standardize main processes or interventions beforehand, but how they were implemented was dependent on implementation choices of the participating departments.

This is represented in for example the choice of the screening instrument, the choice of the (different) structures for multidisciplinary meetings with geriatrics input, the broad eligibility criteria for receiving CWH, the recommendations for tailored interventions for individual patients as opposed to the same intervention package for all patients, the efforts to cooperate with primary care physicians, and the continuous efforts in education and feedback of the CareWell team to the nurses and physicians of the participating departments. How the different elements of CWH were implemented was intensively and continuously discussed between the research team and the participating departments, in which important stakeholders were involved. This actually fits in the trend of performing more pragmatic studies (or: phase IV implementation studies\(^\text{17}\)) which focuses on narrowing the gap between research and practice and really making a structural and sustainable change. Pragmatic studies are designed to learn whether a program works in the real world, as opposed to ideal conditions in a RCT.\(^\text{18}\) Pragmatic studies address specific practice needs and questions of practitioners, policy makers and patients, and thereby focus on application/usefulness, context, success factors, replication and brief, broadly applicable measures that are sensitive for change.\(^\text{18}\) It may be clear that implementing transition experiments or pragmatic interventions has consequences for its evaluation. Did we anticipate enough on this issue in CWH?

**Evaluation CareWell in Hospital program**

One of the conclusions from the systematic review to search for effective hospital-wide interventions to improve hospital care for elderly inpatients was that researchers face various methodological challenges in developing innovative evidence-based frailty oriented hospital services.\(^\text{8}\) Many difficulties exist in finding the proper evaluation
methods for this complex subject focusing on extremely heterogeneous patient groups, settings, interventions and research possibilities. Even the classical (cluster) randomized controlled trial (RCT) often does not fit the complex nature of changes in our complex hospital health care, which can often only be partly completely pre-planned or predicted. In other words, it is a too limited reproduction of the real world. So also innovative research methods are needed. Although carefully planned and performed, the CWH study struggled with this issue. This may be caused by the fact that CWH was implemented from the vision of implementing CWH as a transition and quality improvement trajectory for reaching sustainable improvements, while it is primarily being evaluated like a traditional intervention instead of a pragmatic study.

Firstly, CWH included commonly and traditional outcome measures where additional use of pragmatic measures, such as electronically monitored routine data, might have been more appropriate to be used. Pragmatic measures are measures that have relevance to important stakeholders and are feasible to use in most real-world settings to evaluate improvement. Pragmatic measures can be monitored continuously and thereby may facilitate the flexible evaluation of interventions, outcomes and resources next to or instead of monitoring the fixed and limited study measures in a static study design. Within pragmatic studies, it is important to focus on outcomes that are especially relevant to the patients. Use of for example Patient Reported Outcome Measures (PROMs) or Patient Reported Experience Measures (PREMs) would fit in this vision, as well as in the vision of the Dutch Ministry of Health, Welfare and Sports who had the clear goal with the National Care for the Elderly Program to improve outcomes of care among elderly persons age 70 years and older in such way that care is adapted to their needs and preferences, while costs of care remain steady. Use of PROMs/PREMs fits interventions which aim to adapt care provision to individual needs. However, the focus within the CWH study has been distracted from choosing outcome measures that are most important from the perspective of frail elderly patients and their healthcare providers, next to the more traditional outcome measures of which some are controversial to be used for frail elderly people anyway (e.g. readmissions), because well-developed pragmatic measures for a frail elderly population were not well known at that time and possibly still not sufficiently available. Nevertheless, a quality indicator to measure quality of individualized and integrated hospital care as experienced by elderly patients was developed (CareWell in Hospital questionnaire, Chapter 4). Unfortunately, the quality indicator was being developed during program implementation instead of that it could be used as a primary outcome measure or as a starting point for intervening.

Another key-issue may have been the timing of patient participation in development and evaluation. Elderly people were involved during the process of grant writing and were updated about the research process which was a strength of the CWH program at that point. However, except for participation of elderly patients within the research
process evaluation, elderly people were not explicitly involved later on during the implementation and change process, which receives more attention nowadays. True inclusion of perspectives of frail elderly themselves in developing and choosing outcome measures and interventions and their evaluation is an issue to pay even more attention to in future research. And for both researchers, care providers and patients, it is important to define “what is taken to be successful management of a patient”. 

Thirdly, from the process evaluation within CWH, it was found that implementation processes were well accepted but they were still ongoing at the time of the measurement periods. However, in concordance with RCT standards as well as the restriction by funding, effects were in fact measured at a preplanned and fixed point in time, and CWH showed no effects on primary outcome measures (yet), though secondary outcomes showed promising results. For improvement trajectories as CWH and related (cost)effectiveness evaluation, time should be taken into account more explicitly as effects may not be constant over time. For pragmatic trials, it is important to understand temporal patterns, the changes over time, and their implications for effectiveness of an intervention. In addition, if the CWH study is seen more as a pragmatic/quality improvement/transition trial than an explanatory trial, the trial should have taken longer periods of follow-up, repeated follow-up, and larger sample sizes in order to examine real effects. For pragmatic trials, as different from regular evaluation designs like RCT’s, large sample sizes are necessary to conclude the effect of an intervention.

Nonetheless, what was performed within the evaluation of CWH and what fits well within evaluation of transition experiments was a thoroughly performed process evaluation. Process evaluation was used both during implementation processes in order to guide the change process as well as for interpreting results, which fits both transition management as research and pragmatic trials. Understanding the mechanisms of implementation processes – preferably by the use of mixed, both quantitative and qualitative methods – is important for pragmatic trials, as well as the feedback which process evaluation provides. As no standardized formats for connecting process evaluation to outcome measurements existed, a framework for uniform presentation of process measures was proposed (Chapter 7). This framework may support the current increasing focus on process and quality control evaluation in trying to deal with the complexity of the evaluation of innovative and multi-component interventions.
Future perspectives

The CWH program was implemented as a transition experiment and would – following from the previous paragraphs – preferably have had more time to be evaluated with additional use of more simple and pragmatic evaluation strategies, including intensified inclusion of perspectives of both the elderly patients as well as of the healthcare providers. Hence, in the CWH study and for future research, outcomes should probably be based even more explicitly on needs and perspectives among the frail elderly and changes in care systems should be based even more explicitly on needs and perspectives from the healthcare professionals who are directly responsible for patient care. To facilitate this, a few directions for future research are proposed.

Patients – Patient Reported Outcome/Experience Measures

An upcoming field of interest in outcome measures is that of Patient Reported Outcome Measures (PROMs) and Patient Reported Experience Measures (PREMs). The challenge for the future would be to come to an appropriate, standardized, interpretable and workable set of PROMs/PREMs and objectified effectiveness outcome measures for the frail elderly population: these may be very different from other patient groups due to their frailty status and trajectory of rehabilitation, i.e. not limited to classical outcomes like mortality, morbidity, readmission, functional performances and healthcare utilization. Satisfaction with care and wellbeing throughout hospital stay are probably increasingly important as the life expectancy for frail elderly persons decreases, and reaching the end of life in an acceptable manner may be a preferred goal in a relevant proportion of these frail persons. Probably more importantly, a more goal-oriented approach in making healthcare decisions and assuring autonomy, more than just assessing outcomes and measuring success, would be helpful in providing truly effective and patient-centered care and including frail elderly patients’ preferred outcomes (e.g., shared goal setting as a responsive outcome measure31). This notion of shifting weight to other outcomes is still only preliminary explored in clinical hospital practice and science.24 It is time to make a shift in this domain. And as many hospitals are now integrating their data in electronic patient records, which could also serve research, those outcomes should thus be gathered electronically from and within electronic patient records and provide the necessary information from this growing patient population, for clinicians, hospital management, future patients and researchers.33,34 In addition, if frailty indices would be prospectively generated from electronic patient records it can possibly, together with PROMs, provide the ability to properly target interventions and monitor and compare outcomes for frail elderly patients. And to finish, improving PROMs/PREMs may also indirectly lead to improved ‘traditional’ outcome measures.
Healthcare professionals – Education

Another direction for future research is education of healthcare professionals. As mentioned before, in transition experiments a philosophy of learning-by-doing and doing-by-learning should be adopted, and healthcare professionals’ perspectives should be explicitly included in development, implementation and evaluation. When trying to realize that, an important notice is that the CWH program and other current models of geriatric care actually supplement other medical specialties in the process of providing integrated care for frail elderly patients with complex needs, rather than that care tailored to the individual needs of frail elderly patients is a common practice from their perspective. In these models—for example used in oncology, trauma surgery, emergency wards, orthopedics, and cardiology—geriatrics medical skills and individual training to residents and nurses are offered but actual care provision remains dependent on the non-geriatrics specialists, while they themselves may not have explicitly focused on non-medical needs and preferences of frail elderly patients. In the rapidly changing and complex hospital environments and financing systems, priority-setting may also be different between different stakeholders, either or not forced by external pressures such as reducing length of stay or preventing readmissions due to healthcare insurers’ financial penalties. Non-geriatric healthcare professionals may not focus enough on ‘the broader or generalist perspective’ and/or they may be restricted by ‘the system’ to do so, whereas many are willing to do so.

Therefore, educating professionals in the physiology, recognition and adaptation of care in the domain of frailty is a first priority to improve hospital care for elderly patients, before one can successfully implement (other) geriatrics models of care. Not only the researchers or the intervention team should adopt the philosophy of learning-by-doing and doing-by-learning, but most of all the healthcare professionals should be trained to adopt these competencies. For that reason, the CareWell team put a lot of effort in education and training on the job, as the skills and competencies among the geriatrics teams concerning collaboration and establishment of a sense of urgency of changing hospital care to the general frail elderly population among medical specialists become increasingly important now. But besides the changing competences among geriatrics specialists in advocating geriatrics policies, preferably everybody should be strongly stimulated to fundamentally re-think hospital service provision for frail elderly patients, as elderly patients institute 40-50% of all bed days. Movements such as the Senior or Elder Friendly Hospitals are encouraging in the transition towards hospital-wide safe and efficient care systems, processes and physical environment, which is supported by elder-friendly hospital policies, procedures and social climate.35,36 Another example is the development of hospital care pathways for elderly patients, in which geriatric medicine is more often incorporated with other medical specialties on their request, for example in co-management models in orthopedics (hip fractures)37, cardiology38, oncology39
and emergency medicine\textsuperscript{40}. Another interesting example, going in the direction of education and system-level change, is the NICHE model (Nurses Improving the Care of Healthsystem Elders\textsuperscript{41-43}). In that, measuring care provision from the healthcare providers’ perspectives, as done with GerINCQ (chapter 4), is important as a starting point for (further) quality improvement as well as an important outcome measure next to patient-related outcome measures that are being used now. And maybe even other models of care can be thought of when developing them from the users’ perspectives, e.g. educating more specialized staff on departments or investigating possibilities of role redefinition.

**Researchers – Frailty triage**

In the face of pragmatic trials and intervening with frailty in particular as in CWH, providing attention to appropriate patient targeting may be especially important regarding effectiveness, efficiency and efficacy. Hospitals are forced to ensure that only those patients who really benefit from the investment and show the added value both quantitatively and qualitatively should be eligible for receiving a CGA and indicated interventions. Therefore, instruments are developed to figure out which elderly patients should receive additional attention and interventions to prevent hospital-acquired complications and (further) functional deterioration.\textsuperscript{44,45} These include for example:

- Identification of Seniors at Risk (ISAR);
- Hospital Admission Risk Profile (HARP);
- Triage Risk Screening Tool (TRST);
- Score Hospitalier d’Evaluation du Risque de Perte d’Autonomie (SHERPA);
- Brief Risk Identification for Geriatric Health Tool (BRIGHT);
- Hospital Elder Life Program screening criteria (HELP); and
- Dutch Safety Management System screening bundle frail elderly (VMS)\textsuperscript{46}.

Screening items may include for instance age, physical parameters, laboratory markers, hospitalization history, polypharmacy, geriatric conditions or co-morbidities, functional impairments and social problems. But as it is with a definition for frailty, no uniform screening instrument identifies all patients at risk for functional decline appropriately\textsuperscript{44}, so although screening may help to identify those patients who need additional interventions the most, the pros and cons and the specific aims of instruments should be considered when choosing an instrument. In case of CWH, the VMS screening criteria were used from a practical perspective, however scientifically this ‘instrument’ was not yet validated.

On the other hand, the instruments mentioned above assess a risk for adverse events or triage for targeting an intervention, and are not explicitly used or validated for frailty screening (e.g. Fried phenotype\textsuperscript{47}) or frailty assessment (e.g. Rockwood...
General discussion

frailty index\textsuperscript{47}). Nonetheless, interest from medical disciplines for targeting based on frailty is increasing. Links between frailty and other diseases are being made, and studies determining the predictive value of frailty (indices/scales) towards patient outcomes are being performed more often. It is the challenge to deliver the proper multi-factorial interventions based on screening or assessments in order to meet the needs of the changing and ageing hospital patient population, next to geriatrics departments and specialized geriatrics teams which already exist for years. The needs and expectations of frail elderly inpatients are different from the general hospital population and the fit elderly hospital patients, and therefore requires a different approach in hospital management and processes. As there are no clear frailty screening instruments, creating prospective (Rockwood) frailty indices from patient files should be made easily accessible as many important and informative data are already being gathered from patients. This should be an area for further research.

Concluding remarks

Much of the current hospital care provided is used to serve and support elderly people. Frailty is a common clinical condition among these elderly persons. Frail patients are vulnerable to adverse events, to developing geriatric syndromes and to experiencing functional decline. Current developments force healthcare providers to offer frailty-based practices to all frail elderly people. New innovative geriatrics interventions should be developed, implemented and evaluated preferably as pragmatic trials – including larger sample sizes and longer time periods for transition – in which the priorities of the patients themselves should be the main focus and professionals should be educated in applying the fundamentals of geriatric medicine to their frail elderly patients. The CareWell in Hospital program can serve as an example of a successful transition experiment. For future evaluation of similar trajectories, using well-developed quantitative and qualitative patient reported outcomes and (other) pragmatic measures, both ideally monitored electronically, should realize next steps on the challenging transition path of modern hospital care that we walked on during this study.
References


Summary
Background & problem statement

Much of the acute care provided in hospitals concerns care for elderly people. An important and very common clinical condition among this patient group is frailty. As a consequence of reduced physiological reserves among those frail elderly persons, they are vulnerable for adverse events such as delirium, functional decline, disability, independency, hospitalization, and increased care needs. But not only their functional reserves and the acute illness or chronic disease for which they were admitted to hospital makes them vulnerable for adverse events. Hospital stay in itself is also a risk factor for adverse events. The quality of hospital care probably plays an important role both in success rate of recovery of functional loss that occurred (shortly) before admission due to the illness which lead to hospital admission as well as in preventing additional functional decline during hospitalization. It is assumed that hospital-acquired delirium, functional decline and frailty can be prevented, delayed or treated if appropriate interventions and care are provided adequately.

Therefore, this thesis focuses particularly on how to optimize hospital-wide care for elderly patients. The National Care for the Elderly Program (NCEP) offered the opportunity to experiment in reorganizing care for elderly persons with complex needs by funding so-called transition experiments, which have the goal to improve care structurally and across all disciplines involved in providing care and welfare services. How this should be done exactly in case of Dutch hospital care for frail elderly patients, was not yet known or was not yet done at the start of the National Program. Hence, the main question in this thesis is:

What is the feasibility and effectiveness of an integrated and multi-component hospital-wide care program – the CareWell in Hospital program – developed to maintain or improve autonomy, independence and quality of life among persons age 70 years and older?

Subsequently, several sub-studies were performed to answer this question.

Performed studies & Results

First, a systematic review was performed in order to review the evidence for hospital-wide interventions for elderly inpatients (Chapter 1). From the 20 included articles for analyses, no single best hospital-wide intervention could be identified, probably due to the heterogeneity and complexity of interventions and settings. However, several interventions had positive results, such as the Hospital Elder Life Program (HELP), which formed the base of the CareWell in Hospital Program (CWH).

As it was necessary to modify HELP to what is feasible for a hospital in the Dutch healthcare setting as well as to determine the feasibility of gathering research data, CWH was piloted on one hospital ward including 56 patients (Chapter 2). See figure
1 for the contents of CWH. Overall results of this pilot were judged successful, which resulted in the start of a larger effect study. In addition, during the pilot study and effect study, two questionnaires were developed and validated.

First, the CareWell in Hospital questionnaire for elderly inpatients was developed and validated in order to assess how hospitalized elderly patients experience several important aspects of individualized and integrated care, related to the principles and goals of CWH such as autonomy, independence, well-being, individualized care, communication, coordination of care, continuity of care, and patient safety (Chapter 3). The questionnaire consists of 8 key-items. It was validated using data of 470 patients who had been admitted to one internal medicine, one geriatric, and two surgical departments within the Radboud university medical center. The questionnaire showed good content validity, internal consistency and test-retest reliability, but responsiveness should be explored further before it can be used widely as an innovative measure of frail elderly inpatient experiences with individualized and integrated hospital care next to more traditional effect measures.

Second, the Geriatric In-Hospital Nursing Questionnaire (GerINCQ) was developed and validated in order to measure hospital nurses’ geriatric practices regarding, attitudes towards and perceptions about geriatric care, as nurses are key players in providing direct patient care and them having a positive attitude, a strong working knowledge and competences with respect to geriatric patients is essential for improving the quality of care for elderly patients (Chapter 4). Items from two published instruments were extracted for use in the questionnaire, also related to the principles and goals of CWH. The initial questionnaire’s content was validated by performing three Delphi rounds in which the concept was presented to a panel of sixteen experts (thirteen advanced geriatric nurses and three geriatricians) from ten large teaching and two university hospitals. Next, internal consistency, intra-rater reliability, differences between hospital departments, and sensitivity for detecting changes before and after implementation of CWH was investigated using data of nurses from various departments and hospitals. The GerINCQ comprises 5 subscales and 67 items and showed reliable, had satisfactory construct validity, and showed sensitive to detect changes over time. It may be used as a measure for monitoring and evaluating the organizational and educational effects of geriatrics programs on nurses’ geriatric practices, attitudes and perceptions (e.g. the GerINCQ was sensitive for changes in the CWH before-after study (p<0.01) and showed a high effect size (0.5)).

Next, as from the systematic review it was found that it is highly challenging to collect high-quality evidence from complex interventions to improve care for elderly inpatient, it is suggested that process evaluation should be an explicit and pre-existing component when designing trials of complex interventions. Specifically, it is suggested that process evaluations incorporate “core process measures” that describe the
Figure 1 Schematic overview of the components of the CareWell in Hospital (CWH) program.

Upon admission, patients were initially screened by nurses for their risk of experiencing delirium, falls, malnutrition, and/or physical decline during the hospital stay. If there is a risk of $\geq 1$ items, a geriatric nurse judged whether or not the patient is frail and would benefit from (parts of) CWH. If so, a care plan with nursing, medical, and medication recommendations was offered to the nurses and physicians in the department. At the time of discharge, valuable information was provided for inclusion in the discharge letter to go to the primary care physician. If judged valuable, one or more of the four optional interventions (I through IV) was performed. CGA = Comprehensive Geriatric Assessment. Activities performed by volunteers are designed to provide cognitive and physical stimulation.

degree of implementation of the intervention in the trial and that they should be published alongside the results of their effect (Chapter 5).

Accordingly, a graph is developed with the aim to facilitate the reporting of process evaluation’s results, based on a narrative review of the literature for process measures used in complex interventions for elderly people (Chapter 6). From 17 included articles it was found that process evaluations should address whether the intervention was implemented successfully, was evaluated properly, and can be continued in the future. A flowchart based on the essential components of an
adequate process evaluation was developed. A simplified figure reporting a summary of the results of the process evaluation is proposed and its use is explained by administering the figure to two studies including a process and effect evaluation of a complex intervention.

After having done the above, the implementation and effects of CWH on one internal medicine and two surgical departments in the Radboud university medical center were evaluated (Chapter 7). The program was implemented from April 2011. A mixed-methods process evaluation and before–after study were performed during a 1-year implementation period. Implementation was satisfactory but CWH was not fully integrated yet, as the care processes for frail elderly patients positively changed but changes were ongoing. 191 pre-intervention and 195 post-intervention patients age ≥70 years were included for the effects evaluation. Overall, no significant differences in primary endpoints were found, though mean ADL between discharge and follow-up improved and caregivers rated burden of care lower at three months post-discharge. Especially among surgical patients cognitive functioning at discharge was improved, ADL functioning improved significantly, and informal caregivers reported a lower burden of care three months after discharge. Therefore, the CWH program may be a valuable intervention to prevent commonly experienced complications among frail elderly patients. However, in order to measure the maximum effects of this program, probably a longer period of implementation and monitoring is needed, as well as the use of innovative patient reported outcome/experience measures in addition to commonly used health-related or disease-related outcome measures.

Finally, as economic evaluation is a commonly used outcome measure but rarely includes healthcare resource use post-discharge, we valued post-discharge healthcare consumption data as gathered from CWH using the Older Persons and Informal Caregivers Survey Minimum DataSet (TOPICS-MDS) from the NCEP (Chapter 8). In total, data of 202 patients were included in analyses. From analyses it was concluded that when using data on post-discharge healthcare consumption among (frail) elderly patients for outcome measures, researchers should prioritize data collection to main cost-drivers such as hospital (re)admissions, institutionalization and homecare (preferably not self-reported data), and monitor frailty as a continuous outcome and effect modifier.

Discussion, Conclusion & Future perspectives
Although thoroughly developed and implemented, the evaluation did not show the effects on the primary outcomes regarding maintaining or improving functioning among frail elderly patients as anticipated. This made us search for explanations beyond the discussion points already addressed within the chapters 1-8. The key issue may be that CWH was performed as a transition experiment in real world, but
that it was tried to be implemented and evaluated mainly as a ‘regular trial’ in the sense that it followed scientific rules originating from randomized controlled trials (RCTs). This was further discussed resulting in the recommendations that new innovative geriatrics interventions should be developed, implemented and evaluated preferably as pragmatic trials – including larger sample sizes and longer time periods for transition – in which the priorities of the patients themselves should be the main focus and professionals should be educated in applying the fundamentals of geriatric medicine to their frail elderly patients. The CareWell in Hospital program can serve as an example of a successful transition experiment. For future evaluation of similar trajectories, using well-developed quantitative and qualitative patient reported outcomes and (other) pragmatic measures, both ideally monitored electronically, should realize next steps on the challenging transition path of modern hospital care that we walked on during this study.
Samenvatting | Summary in Dutch
Achtergrond & Probleemstelling

Een groot deel van de ziekenhuiszorg betreft de zorg voor mensen ouder dan 70 jaar, waaronder ook zogenaamde ‘kwetsbare’ ouderen. Deze groep heeft een risico op ongewenste uitkomsten van een ziekenhuisopname, als gevolg van verminderde fysiologische reserves. Bij ongewenste uitkomsten kan gedacht worden aan onder andere het ontwikkelen van een delier (acute verwardheid), functionele achteruitgang, afhankelijkheid en een hogere zorgbehoefte. Zie ook figuur 1.

Maar niet alleen hun verminderde reserves en de medische reden waarvoor zij worden opgenomen in het ziekenhuis maken hen kwetsbaar, ook de kwaliteit van de ziekenhuiszorg speelt een rol in het al dan niet optreden van ongewenste uitkomsten. Zie figuur 2. Aangenomen wordt dat de in het ziekenhuis ontstane episodes van delier, functionele achteruitgang en kwetsbaarheid kunnen worden voorkomen of in aantal verminderd wanneer de juiste zorg wordt geboden.

Figuur 1 Kwetsbare oudere patiënten: gevoeligheid voor kritische veranderingen in functioneren.

De stippellijn geven verschillende trajecten weer qua functioneren voor en na ziekenhuisopname die voor oudere patiënten kunnen gelden. Kwetsbare ouderen kunnen herstellen naar hun niveau van functioneren vóór ziekenhuisopname, gedeeltelijk of helemaal, en er kunnen verschillen zitten in de snelheid van herstel. Maar patiënten kunnen ook niet functioneel herstellen, verder achteruit gaan in functioneren of zelfs overlijden. Het vertragen van het herstel tot een niveau onder het beginniveau vóór ziekenhuisopname is kenmerkend voor kwetsbaarheid en het ontstaan van afhankelijkheid na opname (A).

Maar niet alleen hun verminderde reserves en de medische reden waarvoor zij worden opgenomen in het ziekenhuis maken hen kwetsbaar, ook de kwaliteit van de ziekenhuiszorg speelt een rol in het al dan niet optreden van ongewenste uitkomsten. Zie figuur 2. Aangenomen wordt dat de in het ziekenhuis ontstane episodes van delier, functionele achteruitgang en kwetsbaarheid kunnen worden voorkomen of in aantal verminderd wanneer de juiste zorg wordt geboden.
Daarom hebben we ons in dit proefschrift gericht op hoe we de ziekenhuiszorg voor ouderen kunnen optimaliseren. Het Nationaal Programma Ouderenzorg (NPO) heeft ons de kans geboden om te experimenteren in het reorganiseren van de zorg voor ouderen met complexe zorgbehoeften, door financiering van zogenaamde transitie-experimenten. Transitie-experimenten in de gezondheidszorg zijn grote en

**Figuur 2** Interactie van patiënt-gerelateerde en ziekenhuiszorg-gerelateerd factoren die een (versterkte) functionele achteruitgang (kunnen) veroorzaken.

Zorgprocessen in het ziekenhuis die niet zijn afgestemd op de individuele behoeften en frequent voorkomende gezondheidsproblemen van kwetsbare oudere patiënten kunnen tot een grotere afhankelijkheid van anderen leiden, naast verdere toenemende kwetsbaarheid en andere complicerende aandoeningen.

Daarom hebben we ons in dit proefschrift gericht op hoe we de ziekenhuiszorg voor oudere patiënten kunnen optimaliseren. Het Nationaal Programma Ouderenzorg (NPO) heeft ons de kans geboden om te experimenteren in het reorganiseren van de zorg voor ouderen met complexe zorgbehoeften, door financiering van zogenaamde transitie-experimenten. Transitie-experimenten in de gezondheidszorg zijn grote en
complexe interventies die als doel hebben om de zorg structureel te verbeteren. Hoe dit precies gedaan moet worden in het geval van de Nederlandse ziekenhuiszorg voor kwetsbare oudere patiënten was nog niet bekend bij start van het NPO. De belangrijkste vraag die we met dit proefschrift wilden beantwoorden, was dan ook:

**Wat is de haalbaarheid en effectiviteit van een ziekenhuisbrede interventie – het GIDZ programma (Geriatrie In De Ziekenhuizen) – die ontwikkeld is voor behoud of verbetering van autonomie, onafhankelijkheid en kwaliteit van leven onder mensen van 70 jaar en ouder?**

Om deze vraag te beantwoorden zijn verschillende deelonderzoeken uitgevoerd.

**Uitgevoerde deelonderzoeken**

We zijn begonnen met een zoektocht in de literatuur naar bestaande ziekenhuisbrede zorgprogramma's die ontwikkeld zijn om de zorg voor opgenomen oudere patiënten te verbeteren (**hoofdstuk 1**). We vonden geen 'beste' zorgprogramma. Toch lieten verschillende onderzoekers wel positieve resultaten zien, zoals het Hospital Elder Life Program (HELP), waarop het GIDZ programma uiteindelijk deels gebaseerd is. Zie figuur 3 voor een schematisch overzicht van het GIDZ programma. Om te bepalen of het GIDZ programma en de bijbehorende evaluatie haalbaar was, hebben we eerst een zogenaamde pilot uitgevoerd op twee afdelingen in een kleiner ziekenhuis (UCCZ Dekkerswald). De resultaten bleken positief (**hoofdstuk 2**), waardoor we met een groter onderzoek in het Radboudumc konden starten.

Tijdens implementatie en evaluatie van het GIDZ programma hebben we ook nog twee vragenlijsten ontwikkeld en gevalideerd (= meten we wat we willen meten?). De eerste vragenlijst betreft een vragenlijst voor oudere patiënten die opgenomen zijn geweest in het ziekenhuis, om te beoordelen hoe zij de zorg in het ziekenhuis hebben ervaren (**hoofdstuk 3**). De vragen hebben betrekking op autonomie, onafhankelijkheid, welzijn, persoonsgerichte zorg, communicatie, coördinatie van zorg, continuïteit van zorg en veiligheid. Doel van de vragenlijst is om de kwaliteit van zorg vanuit de doelgroep zelf te bepalen, naast de meer traditionele uitkomstmaten die gebruikt worden om de kwaliteit van zorg te meten. De vragenlijst, bestaande uit 8 kernvragen, bleek inhoudelijk goede vragen te bevatten en consistent te worden beantwoord door patiënten. Of we met deze vragenlijst verschillen vóór en na invoering van zorgprogramma's kunnen meten, en dus als uitkomstmaat kunnen gebruiken, moet verder onderzocht worden.

De tweede vragenlijst betreft een vragenlijst om de houding en ervaringen met zorg voor oudere patiënten onder verpleegkundigen te meten (**hoofdstuk 4**). Verpleegkundigen zijn een hele belangrijke speler in de directe zorgverlening. Een positieve houding en goede vaardigheden onder verpleegkundigen is dan
ook essentieel voor het verbeteren van de zorg voor oudere patiënten. Ook deze vragenlijst, bestaande uit 67 kernvragen, bleek inhoudelijk goede vragen te bevatten en consistent te worden beantwoord door verpleegkundigen. We zagen zelfs al positieve verschillen vóór en na invoering van het GIDZ programma.
Zoals uit het literatuuronderzoek bleek, is het zeer uitdagend om wetenschappelijk bewijs te vinden om het effect van zorgprogramma’s voor ouderen in het ziekenhuis aan te tonen, omdat die vaak veel verschillende onderdelen bevatten, aangeboden worden aan een hele heterogene groep oudere patiënten en ingevoerd worden in een snel veranderende ziekenhuisomgeving. Meerwaarde voor ouderen aantonen is moeilijk op basis van de huidige wetenschappelijke standaarden, die niet zijn gemaakt voor complexe interventies die bij transitie-experimenten worden uitgevoerd en niet zijn voorgelegd aan panels van ouderen. Daarom hebben wij gesteld dat zogenaamde procesevaluatie en deelname van ouderen aan ontwikkeling van interventies en proces- en uitkomstevaluaties een expliciet onderdeel moet zijn van de evaluatie van zorgprogramma’s voor kwetsbare ouderen. Een selectie van procesmaten zou gebruikt moeten worden om de mate van implementatie te bepalen. Vervolgens dienen de resultaten van de procesevaluatie samen met de evaluatie van effecten gepubliceerd te worden, voor een volledig begrip van de waarde van het zorgprogramma (hoofdstuk 5).

Om de weergave van de resultaten vanuit procesevaluatie te faciliteren, hebben we op basis van andere procesevaluatie die beschreven zijn door andere onderzoekers een schematische figuur ontwikkeld (hoofdstuk 6). Uit een vergelijking van 17 procesevaluatie concludeerden we dat het met name belangrijk is om te bepalen 1) of de implementatie succesvol was, 2) of de evaluatie geschikt was, en 3) of het zorgprogramma ook na de onderzoeks-/subsidiefase uitgevoerd werd of kon worden. Onder elk van deze drie hoofdthema’s zijn een aantal procesmaten geformuleerd, zoals het aantal mensen aan wie extra zorg is aangeboden en of dit de juiste doelgroep was, in hoeverre zorgprofessionals het zorgprogramma daadwerkelijk hebben uitgevoerd, of voldoende en de juiste gegevens zijn verzameld voor de evaluatie, en in hoeverre het zorgprogramma geïntegreerd is in bestaande zorgstructuren. Daarvan kunnen de antwoorden overzichtelijk in één figuur weergegeven worden, samen met een overzicht hoe het (zorg)programma en de opzet van het onderzoek eruit zag. Zie figuren 2 en 3 op pagina 89 en 93. De figuur kan dienen als een samenvatting van de resultaten van procesevaluatie, maar het kan ook worden opgenomen in publicaties over effecten van zorgprogramma’s om de interpretatie van de resultaten te ondersteunen.

Binnen het wetenschappelijke onderzoek dat we hebben uitgevoerd rondom de ontwikkeling, implementatie en evaluatie van het GIDZ programma, hebben we zelf natuurlijk ook een procesevaluatie en een effectmeting uitgevoerd (hoofdstuk 7). Dit hebben wij gedaan op drie afdelingen in het Radboudumc, waarvan twee chirurgische afdelingen en één interne geneeskunde. Het programma werd ingevoerd vanaf april 2011. Voor het onderzoek werden drie maanden vóór start van het GIDZ programma, en drie maanden na een jaar na invoering van het GIDZ programma allerlei gegevens verzameld van patiënten, om later het effect op de kwaliteit en uitkomsten van zorg te
kunnen bepalen (een nul- en nameting). Gedurende deze hele periode, dus bijna 1,5 jaar, is ook continue het proces van de invoering gemonitord. De uitvoering van het GIDZ programma was bevredigend, maar het programma was nog niet volledig geïntegreerd in de zorgprocessen na één jaar. Er waren ten tijde van de ‘nameting’ nog steeds positieve veranderingen gaande. We zagen echter al wel verbeteringen in functioneren tussen ontslag en drie maanden na ontslag, en een verminderde belasting onder mantelzorgers van met name chirurgische patiënten (in de studie om methodologische redenen secundaire eindpunten genoemd). In de ‘primaire eindpunten’ konden we geen verbetering vaststellen: het aantal delieren dat voorkwam was in feite al laag. Een andere verklaring hiervoor is dat we ‘te vroeg’ gemeten hebben, gezien de complexiteit van invoering van de interventie. Verder kan het nog zijn dat we niet de beste eindpunten hebben gekozen. Wat betreft die eindpunten is het bij toekomstig onderzoek van groot belang dat eindpunten nog sterker worden geformuleerd en gekozen vanuit het perspectief van de doelgroep zelf.

Als laatste hebben we onderzocht wat het zorggebruik van patiënten van 70 jaar en ouder is in de periode van ontslag tot drie maanden na ontslag. Hieruit bleek dat onderzoekers in studies gericht op analyse van de kosten, zich bij het verzamelen van gegevens in ieder geval moeten richten op ziekenhuis(her)opnames, overplaatsing naar een zorginstelling en thuiszorg, omdat de kosten hiervan relatief hoog zijn en daardoor de meeste (±90%) invloed hebben op kosten(effectiviteit)berekeningen. Daarbij gaat de voorkeur ernaar uit om de gegevens over zorggebruik niet aan de patiënt zelf te vragen, maar indien mogelijk vanuit bestaande databases, omdat we bij een kwetsbare groep mensen een hoger risico lopen dat zij geen of niet juist ingevulde vragenlijsten terugsturen, doordat ze zich bijvoorbeeld niet alles goed herinneren of er liever niet aan terugdenken. Dit kan grote invloed hebben op de interpretatie van de resultaten.

**Discussie, Conclusie & Toekomstperspectieven**

Hoewel wij het GIDZ programma zorgvuldig hebben ontwikkeld en geïmplementeerd en op een aantal belangrijke punten meerwaarde zien en ervaren, hebben wij nog geen vermindering van delieren en functieverlies gedurende de ziekenhuisopname gerealiseerd. Belangrijkste verklaring daarvoor is dat het evaluatie onderzoek waarschijnlijk te kort heeft geduurd en nog niet optimaal was ingericht op complexe interventies. We hebben dit methodologische spanningsveld in het discussiehoofdstuk verder toegelicht, waaruit vervolgens een aantal aanbevelingen naar voren zijn gekomen. Die aanbevelingen richten zich op het meer pragmatisch evalueren van innovatieve en complexe zorgprogramma’s over een langere tijdsperiode, het nog explicieter meenemen van het perspectief van de doelgroep in alle fasen van implementeren en evalueren van zorgprogramma’s, en het (beter) scholen van zorgprofessionals op het gebied van zorg voor kwetsbare oudere patiënten. Het GIDZ
het programma is echter al met al een zeer succesvol transitie-experiment geweest, dat een zinvolle interventie heeft opgeleverd met meerwaarde voor kwetsbare ouderen in het ziekenhuis en dat ons relevante lessen heeft geleerd over innovatie en evaluatie van ziekenhuiszorg voor kwetsbare ouderen.
Dankwoord | Acknowledgements
Publications
Curriculum Vitae
Dankwoord

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Bij de wetenschappelijke evaluatie van het GIDZ programma zijn veel mensen betrokken geweest, maar minstens zo belangrijk zijn al die mensen die het GIDZ programma in de praktijk hebben uitgevoerd.

- **De leden van de GIDZ-teams en transitieteams, en zorgprofessionals** betrokken bij de pilot van het GIDZ programma op Dekkerswald, in het bijzonder: Jeanine Antons, Johan Molema, Monique Reijers, Annemiek Koopmans, Gert-Jan Hof, Marleen Zoetemeijer, Marije ten Dam, Jacqueline Lagé, Saskia de Kleijn en Betty Wouters;


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Ik heb echt geweldige bewondering voor de wijze waarop iedereen op zijn/haar eigen wijze een steentje heeft bijgedragen in de transitie naar betere ziekenhuiszorg voor de oudere patiënten; enthousiast, behulpzaam, welwillend, meedenkend, betrokken en dat alles in zowel de uitvoering als de (tijdrovende) evaluatie. Datzelfde geldt voor de **GIDZ vrijwilligers**, die met volle inzet ontzettend veel belangrijke activiteiten hebben gedaan met de patiënten die dit nodig hadden.
Vaak werd mij gevraagd of ik al bijna afgestudeerd was. Misschien niet eens zo’n rare vraag, want soms voelde het ook als een tweede studietijd door alle leuke dingen die we gedaan hebben met de groep promovendi: de Carréloop met rollator als estafette-stokje, het maken van filmpjes en cadeaus voor promoties, Radboud Rocks, dies-festival, Zevenheuvelenloop, samen inpakken van proefschriften, weekendjes naar België en de zee, Lowlands, Marikenloop, dagelijks koffiepauzelol, maandelijkse borrels, Vierdaagsefeesten, Nacht der Professoren, pubquizen, 2Bike4Alzheimer, etc. Deze groep weet wat het is om te promoveren; dat op veel dagen je collega’s je enige sociale contacten zijn, de frustratie van het artikelen herschrijven en submitten, dat je op sommige dagen zelf ook niet meer weet waar je nu eigenlijk mee bezig bent, en dat de beste ideeën nu eenmaal bij een borrel ontstaan. Miriam, Olga, Diane, Anne, Freek, Sarah, Janneke, Mirjam, Els, Petra, Geke, Aisha, Gerrita, Daan, Noralie, Sharon, Maaike, Lia, Marjolein, Anke R, Jaap, Cynthia, Anouk, Lotte, Saskia, Anke B, Marieke, Peter, Hans, Jennifer, en Weiqi: jullie hebben een grote en bijzondere rol gespeeld in het plezier (blijven) hebben aan promoveren, dankjulliewel! Ook alle senior onderzoekers, onderzoeks- en projectmedewerkers en stagiaires bedankt voor de nodige ondersteuning en interesse.

De keuze voor mijn paranimfen was snel gemaakt. Wij hebben samen veel leuke dingen gedaan en hebben ongeveer gelijktijdig ons promotietraject doorlopen. Kim, jij staat altijd klaar en trapte wél door achterop de tandem. Jij nam me mee naar de Kings of Leon, omdat je mij ook nog een keer uit m’n dak wilde zien gaan op de live-uitvoering van Sex is on fire. Jouw waardering voor mij bewees zich nogmaals in New Orleans, toen ik weer zo nodig moest salsa dansen, en jij je opofferde aan een ‘grote neger’. Topper! Teun, je wilt graag dat het zo is en ik moet het ook wel toegeven: jij hebt een deel van mijn naïviteit afgenomen. Ik dans op de bar, ik ken meer vieze woorden, en de quoteslijst is ongetwijfeld langer geworden door jouw invloed. Dankjewel... denk ik.

Ik dacht eerlijk gezegd niet weer zo’n leuke groep collega’s te krijgen in een andere baan. Die angst was snel weg toen ik in een enthousiast, motiverend en gedreven team mocht komen werken bij de opleiding Toegepaste Gerontologie in Zwolle. Bedankt voor jullie interesse en support!

Tijdens het promoveren kwam werk eigenlijk te vaak vóór aandacht voor de leuke en lieve mensen die ik om me heen heb. Gelukkig heeft de volleyball me vaak gedwongen om de computer af te sluiten. Bedankt dames voor de gezelligheid rondom de volleyball. Eva, Nicolette en Leonie, vooral jullie zorgden er – met name ná de training – steevast voor dat ik loskwam van het werk óf er even met buitenstaanders over kon praten. Marjon, Rachel, Esther, Marianne, Judith, Roos, Amanda en Mariska,
onze jaarlijkse weekendjes weg en SinterKerst waren ook de afgelopen jaren weer een fijne afleiding van het werk, net als o.a. de gezellige jaarlijkse etentjes tijdens de Restaurantweek met jullie Kim, Dian, Jessica, en Nynke. Het is altijd super gezellig met jullie!

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Lieve Jasper, het hele promotietraject heb jij van begin tot eind meegemaakt. Rond de start van mijn promotietraject zijn wij bij elkaar gekomen. Je hebt me in die tijd altijd vrij gelaten in wat ik wilde doen, ook al hield dat in dat wij elkaar alleen in de weekenden zagen of soms zelfs dat niet. Je bood mij een luisterend oor wanneer dit nodig was en gaf nuchtere adviezen als ik daar om vroeg. Jij hield mij met het zoeken van woorden wanneer ik ze niet kon vinden, zelfs wanneer het om mijn eigen proefschrift ging. En je hoorde mijn spraakwatervallen aan als ik – onder invloed van een gezellig wijntje (of drie) – niet kon stoppen met (te luidruchtig) kletsen. Honey, you’re tougher than the rest... En ik ben dan ook zooom blij dat met de afronding van mijn proefschrift ook voor ons samen een nieuwe periode start. Daar heb ik enorm veel zin in! Echt SUPER!

Lieve papa, wat ik allemaal in Nijmegen heb gedaan, heb ik (te) weinig met je gedeeld. Ook al is ‘doctor’ voor jou minder tastbaar dan ‘dokter’, je steunt me hoe dan ook in het doen wat mij goed lijkt. Voor mij was je juist de afgelopen jaren aanwezig als echte papa. Lieve mama, de tijd van het promotieonderzoek was ook de tijd dat we jou hebben moeten missen. En het is ook de periode waarin ik heel vaak heb gedacht aan wat jij allemaal hebt gedaan, en vooral gelaten, om ons te kunnen laten ontwikkelen tot wie of wat we willen zijn. Ik weet dan ook donders goed aan wie ik deze prestatie nog het allermeest te danken heb...
Publications

Journal articles (this thesis)


Bakker FC, Adang EM, Persoon A, Olde Rikkert MGM. Valuing follow-up data on healthcare consumption among frail elderly inpatients: results of the CareWell in Hospital before-after study. [submitted]

Journal articles (Dutch)


**Book chapters**


**Bakker FC**, Olde Rikkert MGM. Hospital care for frail elderly adults; from specialized geriatric units to hospital-wide interventions. In: Theou O, Rockwood K (ed.). Frailty in ageing: biological, clinical and social implications. Karger, *in progress*
Curriculum Vitae

Franka Bakker was born on April 6, 1987 in Coevorden, The Netherlands. She graduated from secondary school ‘de Nieuwe Veste’ in Coevorden in June 2005. She subsequently received a Bachelor’s degree in Health and Life Sciences (2008) and a Master’s degree in Health Sciences (2010) – specialization Policy and Organisation of Health Care – at the VU University Amsterdam. During her studies she participated in research projects focusing on hospital care for elderly people, from which she could start as PhD student at the Geriatric Medicine department at the Radboud university medical center Nijmegen in 2010. The results of the research she did at this department is presented in this thesis. During her studies, Franka also graduated from the European Masters in Gerontology in 2012. Currently, she works as a researcher and shared project leader in a program called ‘Academia for Informal Caregivers’ at the Geriatric Medicine department at the Radboud university medical center, for which she was nominated for the National Care Innovation Award 2012. In addition, she works as a teacher in Applied Gerontology at Windesheim University of Applied Sciences, Zwolle.
