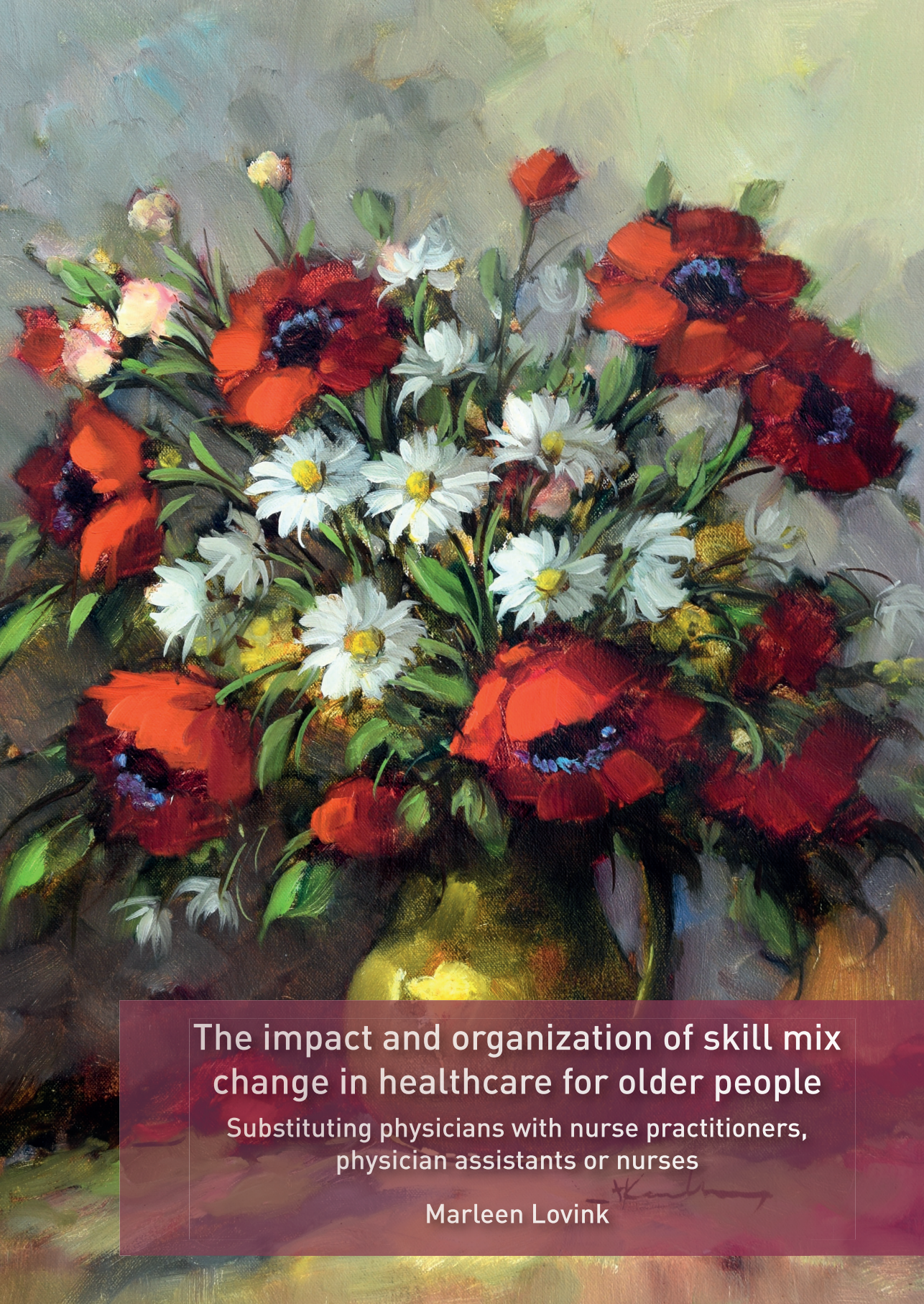

The impact and organization of skill mix change in healthcare for older people

Substituting physicians with nurse practitioners, physician assistants or nurses

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For reasons of consistency within this thesis, some terms have been standardized throughout the text. As a consequence the text may differ in this respect from the articles that have been published.

The studies presented in this thesis have been performed at the Scientific Center for Quality of Healthcare (IQ healthcare). This center is part of the Radboud Institute for Health Sciences (RIHS), one of the approved research institutes of the Radboud university medical center.

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Contents

CHAPTER 1

GENERAL INTRODUCTION

Challenges in healthcare for older people

The world population is aging rapidly and most people in the world are expected to live 60 years and beyond (1). In 2017 around 962 million people worldwide were aged 60 or over, which is 13 percent of the total population (2). In 2050, in most regions of the world nearly a quarter of the population will be aged 60 and over; 2.1 billion people. This may rise to 3.1 billion in 2100. Not only the total number of older people increases, but also the number of oldest old. Globally the number of people aged 80 or over is anticipated to triple by 2015, from 137 million in 2017 to 425 million in 2050 (2).

In the Netherlands, people are referred to as 'older people' from the age of 65. Already in 2040 more than a quarter of the Dutch population will exist of people aged 65 years or over and here too the group of oldest old increases (3). As a result of the aging population and the fact that the chance of developing a chronic disease increases with increasing age, it is expected that the number of older people with a chronic illness and multimorbidity will rise (4). A majority of these older people will require care sooner or later and healthcare costs will rise as care consumption increases. In the Netherlands in 2016, almost half of the healthcare costs was attributed to care for older people (5).

Many older people wish to grow old in their own home, which is also seen as patient-centered healthcare (1, 6). Older people are enabled to continue their normal life as much as possible regardless of their physical and mental capabilities. In the Netherlands, as in other developed countries, governance-reforms are implemented to shift care from hospitals and long-term care facilities to the community (7). These reforms and the growing number of older people, increases the demand on both primary healthcare and on nursing home care to provide suitable care.

Primary healthcare

Primary healthcare in the Netherlands is traditionally delivered by general practitioners (GPs). Other primary healthcare professionals are among others, dentists, physical therapists, social workers and district nurses. GPs are the 'gatekeepers' of medical healthcare, as they are the physicians of first contact with health problems. In the Netherlands there are over 13,447 GPs (8). According to the GPs' professional association, the core values of primary healthcare are being a generalist and to provide person centered care and continuity of care. The fact that older people wish and do grow old in their own home increases the workload for GPs. A quarter of the older people who live independently are vulnerable, and at risk of negative health outcomes like functional decline, hospital admission, and premature death due to an accumulation of physical, psychological and/or social impairments in function (9). This group of older people has a higher care consumption. Chronic illnesses that are common in the older population are diabetes mellitus, arthrosis,

chronic obstructive pulmonary disease, cardiovascular diseases, cancer, dementia and depression (10, 11). Often multimorbidity exists and almost half of the older people has been prescribed five or more medicines, so called polypharmacy, which increases the risk of side effects and noncompliance (12). There is also a risk of malnutrition and falls (13, 14). Older people often have questions regarding vulnerability, welfare and quality of life. Most older people do not know who can address these questions (15). Furthermore, the number of non-Western migrants aged 65 years or over is expected to increase from 78,000 in 2011 to 520,000 in 2050 in the Netherlands (16). Therefore, the diversity among older people increases, which requires person centered care. In 2017, a collaborative agreement has been published between among others GPs, practice nurses and district nurses, to improve collaboration between the professionals in general practices and in the community with the aim to provide person centered care to vulnerable older people (17). To face the challenges that come along with the growing number of older people and to contain costs GPs increasingly work together with nurse practitioners (NPs) or physician assistants (PAs) besides registered nurses (RN). These professionals may work as substitutes for GPs (18).

Nursing home care

In the Netherlands, there are around 313 nursing home organizations. Around 110,000 people lived in a nursing home in 2016. Because only older people with complex healthcare needs are admitted to a nursing home, care intensity increases (19). The illnesses of older people in nursing homes correspond with the ones described above for older people in primary healthcare, albeit at an advanced stage. Nursing homes consist of different types of units like dementia special care units, units for chronically ill people including acute care and palliative care, and units for geriatric rehabilitation. The care given in nursing homes aims to contribute to quality of life at the end of life of older people (20). In 2015 the program 'Dignity and pride' was launched by the Ministry of Health, Welfare and Sport of the Netherlands and in 2017 the 'Quality framework nursing home care' was published, which defines quality standards for care provided in nursing homes (21, 22). Multidisciplinary teams employed by the nursing home organization provide this care and include, among others, the nursing home physician specialist (called elderly care physician (ECP)), nursing discipline, physiotherapist, dietician, and psychologist. Elderly care medicine is a unique specialty with a 3-year training program that exists nowhere else in the world (20). However, there is a shortage of ECPs. At present, 1,699 ECPs are working in Dutch nursing homes, but the vacancy rate is 5.9% (8). This shortage is one of the reasons for why NPs, PAs and RNs were introduced as ECPs substitutes in nursing homes.

Substitution

Substitution for physicians means expanding the breadth of a job by providing the same services as the physician, while the new provider is responsible/autonomous. Besides substitutes NPs, PAs and RNs may also work by means of task delegation or supplementation:

- Task delegation means moving a task to a lower grade provider (physician remains responsible);
- Supplementation means increasing the depth of a job by providing additional services which complement or extend those provided by the physician (23).

In daily practice, the boundaries between the three different forms of skill mix change, substitution, task delegation and supplementation, are not that clear. Skill mix change encompasses mostly a mixture of different forms.

Nurse practitioners

In the late 1990s NPs were introduced in the Netherlands (24). The title 'Nurse Specialist' is used to refer to NPs and is protected by law. NPs are registered in their specialist register. Only RNs who have completed a two-year Master's program called the Higher Professional Education Master's Degree in Advanced Nursing Practice (MANP) may call themselves NP and are registered in the nurse specialist register. Since 2012, NPs are authorized to indicate and perform some of the so-called 'reserved procedures', such as prescribing medication and simple surgical procedures, which were initially only reserved for physicians. This is described in the Individual Health Care Profession Act (Wet BIG), article 36a. Initially, the legislation was temporary, but after an extensive evaluation it became permanent in September 2018 and registration in the 'Wet BIG' mandatory (25, 26). The main characteristic of NPs is the provision of a wide range of preventative, chronic and acute healthcare in a wide variety of clinical settings. An NP is capable of broadening the medical scope and deepening the nursing scope in care for a specific group of patients (27, 28).

Most NPs in the Netherlands work in a hospital. In 2016, around 300 NPs worked in general practices and another 300 worked in nursing homes (29). In the last years, an unknown number of NPs have been trained to work in the community. Although almost all NPs in primary healthcare take care of older people, it is unknown how many NPs focus on healthcare for older people in particular. Systematic reviews of international literature show that general primary healthcare by NPs is effective and safe, but not always less expensive (30, 31). NPs in nursing homes are deployed in a variety of roles internationally as well as in the Netherlands. Examples of roles are: being a fellow practitioner for the physician, being a nursing expert and

being a coach for the care team (32-34). Systematic reviews of international literature indicate that NPs in nursing homes contribute to quality of healthcare (35, 36).

Physician assistants

PAs were introduced in the Netherlands in 2001 and 'Physician Assistant' is a protected title by law (37). PAs are registered in the quality register of their professional association. The training of PAs consists of a 30-months program at a Master's degree level in Physician Assistant (MPA). Just as NPs, PAs are authorized to indicate and perform some of the 'reserved procedures' as described in the Individual Health Care Profession Act (Wet BIG). A PA is capable to broaden and deepen the medical scope within a certain specialism (27, 28).

In accordance with NPs, the majority of PAs is employed in hospitals. In 2016, around 90 PAs worked in general practices and 40 PAs worked in nursing homes but they do not work in the community (38). Research focusing on the substitution role of PAs in hospitals shows equal quality and safety of care on units with PAs compared to units with only physicians (39). However, very little research has been conducted about PAs in primary healthcare and in nursing homes (32, 33, 40). Therefore, it is unknown what the value of PAs in healthcare for older people is.

Registered nurses

RNs are nurses who are educated at Bachelor level. The focus of RNs is on supporting patients in their daily functioning (41). In contrast to NPs and PAs, RNs are only allowed to perform 'reserved procedures' after instructions of a physician (or NP or PA), which can be seen as task delegation (42). However, a study showed that practice nurses (RNs with advanced training) in nursing homes could exempt ECPs for an average of 50%. Which can only be explained by the fact that they substituted the ECPs in other tasks than the 'reserved procedures', for example, in collecting patient information and taking care of patients with diabetes mellitus (32, 33). Other RNs who could be a possible answer to the challenges in primary healthcare for older people and nursing homes are: practice nurses in general practices, district nurses, geriatric nurses and nurses with a specialty in gerontology and geriatrics.

To date, it is unknown what the impact of substituting physicians with NPs, PAs or RNs in healthcare for older people is and how it is organized. In addition, there is no satisfying insight into the factors that influence the organization of substitution. This is important to know, in order to determine how skill mix change could best be organized in order to face the challenges in healthcare for older people.

Aim and outline of the thesis

The central aim of this thesis is to provide insight into the impact of substituting physicians with NPs, PAs or RNs in healthcare for older people and to provide insight into how it can be organized.

The central research questions are:

- What is the impact of substituting physicians with NPs, PAs or RNs in healthcare for older people?
- How is substitution of NPs, PAs or RNs for physicians in healthcare for older people organized and what factors influence the organization?

In this thesis the focus will be on substitution, but this will be studied in the broader context of skill mix change, including task delegation and supplementation.

Chapter 2 presents the study protocol for the systematic literature review that evaluated the effect of physician substitution in primary healthcare for older people and long-term care facilities and described facilitators and barriers to the implementation of physician substitution. The review used Cochrane methods and included comparative study designs.

Chapter 3 describes the results of the systematic literature review. In total, 12 studies were included. The outcomes collected were: patient outcomes, process of care outcomes, resource use outcomes, costs and description of the implementation.

Chapter 4 presents a qualitative study that aimed to describe how skill mix change is organized in daily practice, what influences it and what the effects are of introducing NPs, PAs or RNs into primary healthcare for older people. In total, 34 care providers working in primary healthcare in the Netherlands (GPs, NPs, PAs and RNs) were interviewed in focus groups and individual interviews.

Chapter 5 presents a qualitative study that aimed to describe the ways in which skill mix change is organized through introduction of NPs, PAs, or RNs in nursing homes, what factors influence it, and the perceived effects. In total, 32 care providers working in nursing homes in the Netherlands (ECPs, NPs, PAs and RNs) were interviewed in focus groups.

Chapter 6 presents the study protocol of the multiple-case study that draws upon realist evaluation principles. This study aimed to gain insight into how physician substitution is modeled and whether it contributes to perceived quality of healthcare. Second, this study aimed to provide insight into the elements of physician substitution that contribute to quality of healthcare. In the protocol the initial theory is presented.

Chapter 7 describes the result of the multiple-case study. Seven cases were included. The primary participants were NPs, PAs and RNs (practice nurses). ECPs, managers, members of the nursing teams, and residents and their relatives were included as secondary participants. Data collection consisted of observations, interviews, questionnaires, and analysis of internal policy documents.

Finally, **Chapter 8** provides an overall discussion of the main findings of the thesis. Also the methodological reflections, implications for practice and policy and the recommendations for education and future research are described.

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CHAPTER 2

2

Physician substitution by mid-level providers in primary healthcare for older people and long-term care facilities: protocol for a systematic literature review

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Abstract

Aim: This protocol describes a systematic review that evaluates the effects of physician substitution by mid-level providers (nurse practitioners, physician assistants, or nurses) in primary healthcare for older people and long-term care facilities. The secondary aim is to describe facilitators and barriers to the implementation of physician substitution in this setting.

Backgrond: Healthcare for older people is undergoing major changes, due to population aging and reforms that shift care to the community. Besides, relatively few medical students are pursuing careers in healthcare for older people. Innovative solutions are needed to guarantee the quality of healthcare and to contain costs. A solution might be shifting care from physicians to mid-level providers. To date, no systematic review on this topic exits to guide policymaking.

Design: A quantitative systematic literature review using Cochrane methods.

Methods: The following databases will be searched for original research studies that quantitatively compare care provided by a physician to the same care provided by a mid-level provider: PubMed, EMBASE, CINAHL, PsycINFO, CENTRAL, and Web of Science. Study selection, data extraction, and quality appraisal will be conducted independently by two reviewers. Data synthesis will consist of a qualitative analysis of the data. Funding of the review was confirmed in August 2013 by the Ministry of Health, Welfare and Sport of the Netherlands.

Discussion: This review will contribute to the knowledge on effects of physician substitution in healthcare for older people and factors that influence the outcomes. This knowledge will guide professionals and policy administrators in their decisions to optimize healthcare for older people.

INTRODUCTION

Healthcare for older people is undergoing major changes in developed countries, due to population aging and reforms that shift care from hospitals/long-term care facilities to the community. Besides, relatively few medical students are pursuing careers in healthcare for older people (1-4). In 2030, nearly 25% of the European population (5) and 20% of the American population (6) will consist of adults 65 years and over. Within this aging population the prevalence of (chronic) diseases and multi-morbidity is also expected to increase (6). As a consequence, the need for care becomes more complex and the consumption of care will be higher. Most of these older adults live at home or in long-term care facilities, where a primary care physician (e.g. general practitioners, geriatricians, nursing home physician specialists (3)) is responsible for their medical care. These physicians face heavy workloads (7, 8). Innovative solutions are needed to guarantee the quality of healthcare for older people and to contain costs. A solution might be shifting care from physicians to nurses (i.e. advanced practice nurses) or physician assistants (9, 10).

Background

In various Western countries, two different types of mid-level providers have been introduced: advanced practice nurses/nurse practitioners (in the following referred to as nurse practitioners, NPs) and physician assistants (PAs). A mid-level provider is a medical provider who is not a physician but is licensed to diagnose and treat patients (11). Depending on the country legislation these mid-level providers practice independently or under the supervision of a physician (12, 13). The NPs were introduced in the second half of the 20th century to fill the gap created by the shortage of primary care physicians and to provide care for underserved populations (14, 15). They were introduced in the United States in the 1960s, in Canada in the 1970s, in the United Kingdom in the 1980s, and in Australia and in the Netherlands in the 1990s (16-18). NPs are registered nurses with completed advanced education and clinical training. The education of NPs varies between, and even within, countries and ranges from continued professional education courses, to a bachelor of science, to the level of a master of science (15). They can provide a wide range of preventive and acute healthcare. While NPs combine nursing care with medical care, PAs mainly provide medical care (19). PAs were introduced in the United States in the 1960s to improve and expand healthcare as physicians and educators recognized the shortage of primary care physicians (12, 20). Subsequently, in more recent decades, PAs were introduced in the United Kingdom, Canada, Australia, the Netherlands, and Taiwan (21-23). In most countries, PA courses are graduate programs that lead to a master's degree and the programs consist of a didactic phase and a clinical phase (12). PAs work across a wide range of healthcare settings and in a wide variety of clinical areas.

Healthcare professional roles undergo continuous revision in response to technological, economic, and social changes. This role revision is also referred to as skill mix change and is defined as a change in mix of skills or competencies possessed by an individual (24). The subset of revisions in which mid-level providers take on defined tasks that were previously the domain of physicians alone can be brought about by two different approaches. Mid-level providers may work as a physician substitute or as a physician supplement (24, 25). Mid-lever providers working as a substitute provide the same services as the physician, while those working as a supplement provide additional services which complement or extend those provided by the physician. In some cases mid-level providers work as a physician substitute as well as a supplement; taking over tasks from physician as well as extending his care previously delivered (25). The aim of both forms of role revision is different. The aim of mid-level providers working as physician supplements is to improve the quality of care, extend the range of services available to patients, and to provide preventive care. In contrast, the aim of mid-level providers working as physicians substitute is to reduce the demand for physicians. This review focuses on the impact of mid-level providers working as substitutes for primary care physicians in primary healthcare for older people and long-term care facilities because it might be an answer to the major challenges in these settings.

In some cases nurses, without advanced training, may also work as mid-level providers and substitute physicians (26). The job title, education, and experience of nurses varies considerably among and within countries. As stated above this is the same for NPs. What is called an NP in one country may be called a nurse in another country. Therefore, it is important to focus on the background and tasks these professionals perform rather than on their job title.

Several reviews have compared the care provided by mid-level providers with the care provided by physicians in primary healthcare and long-term care facilities. However, none of the reviews on physician substitution by nurses or NPs in primary healthcare focused specifically on older people (26-29). These reviews concluded that there were no differences in health status between patients receiving first point of contact care from a physician or an NP, patients were satisfied with NP and nurse-led care, and it was concluded that the quality of care provided by appropriately trained nurses is equal to the care provided by physicians (26-28). In most studies, substitution did not lead to an increase in resource use, and costs were neutral and some studies even showed cost savings (26, 27, 29). In 2009 Dennis *et al.* published a review on substitution in primary healthcare for older people, however, studies were included even if a small number of 65 years and over were included in a study. Although the conclusions of this study were equal to the previous reviews, it is difficult to generalize the outcomes to primary healthcare for older people due to selection bias (30).

Three systematic reviews studied which roles NPs fulfill in long-term care facilities and its effects on patient outcomes and costs. Bakerjian (2008) identified five roles, of which two roles can be regarded as physician substitution: 1) provider of primary care to long-term care residents; and 2) provider of acute care to both short-stay and long-stay residents. The other three roles focused on education and consultation. Independent of the provider's role patient outcomes significantly improved and cost were stable, or a reduction in costs was realized (31). The other two reviews showed significant positive effects on patient outcomes (32) and a reduction of hospitalization rates (33). Donald *et al.* (2013) concluded that the improvements were greater than the costs of NP intervention.

As mid-level providers are relatively new healthcare providers who may perform different roles, it is important to carefully plan the implementation of these providers (34, 35). Previously described reviews only focused on the outcomes of care models, but factors that influence the implementation of these models were not included. To implement such a complex organizational intervention, it is however important to also include barriers and facilitators (36). Understanding these factors may improve future implementation of physician substitution in primary healthcare.

In the next decades, the older population will further increases and the organization of care of older people is challenged. A review on the impact and facilitators and barriers of physician substitution by mid-level providers can offer guidance to the organization of healthcare for older people. Previous reviews in general practice and long-term care facilities give an indication of the effects, but have shortcomings, such as inclusion of non-elderly, no distinction between substitute and supplement roles, and restriction to the nursing profession. Besides, knowledge on the facilitators and barriers in different models of physician substitution is lacking. Knowledge on the effects and the implementation process of physician substitution by mid-level providers in primary healthcare for older people and long-term care facilities will be informative to the development of an optimal model for physician substitution in this setting.

THE REVIEW

Aim

The aim has been developed by using the PICO (population – intervention – comparison – outcome) framework outlined by the Cochrane Collaboration (37). The aim is to systematically review the effects on patient outcomes, process of care outcomes, provider outcomes and costs of physician substitution by mid-level providers (NPs, PAs, and nurses) in primary healthcare for older people and long-term care facilities, compared with the effects of care provided by physicians only. The secondary aim is to describe facilitators

and barriers to the implementation of physician substitution in primary healthcare for older people and long-term care facilities. This article describes the protocol for the systematic literature review.

Study design

A systematic literature review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (38) as described in the Cochrane Handbook (37). This article describes the protocol for this review according to the PRISMA-P (protocol) statement (39). Funding of the review was confirmed in August 2013 by the Ministry of Health, Welfare and Sport of the Netherlands.

Inclusion and exclusion criteria

Types of studies

To give an overview of the present stage of knowledge all original research studies with a comparative quantitative evaluation design will be included, such as randomized controlled trials, before-after studies, and cohort studies.

Types of settings

General practices (family medicine), long-term care facilities, home care/community services for older people, hospices, and geriatric ambulatory rehabilitation centers (and thus excluding hospital care). Studies about patients being discharged from the hospital will only be included when primary healthcare providers are involved in this process.

Types of Participants, Interventions, Comparisons, Outcomes (PICO)

Types of Participants:

- Older patients (all patients ≥65 years old, or a mean age of 70 years old);
- Nurses, namely any qualified nurse working as a substitute to a primary care physician, including, advanced practice nurses (NPs, clinical nurse specialists), geriatric nurses, district nurses/ community nurses/health visitors, or practice nurses;
- PAs working as a substitute to a primary care physician;
- Primary care physicians, including general practitioners, family physicians, general internist, geriatricians, and nursing home physician specialist.

Types of Interventions and Comparisons:

Physician substitution by a mid-level provider in medical or preventive care for older patients, compared with care as usual in which no mid-level provider is involved.

1. Care provided by a physician/physicians compared with the same care provided by a mid-level provider/mid-level providers;
2. Care provided by a physician/physicians compared with the same care provided by a team of a physician/physicians and a mid-level provider/mid-level providers.

The care provided should comprise medical and/or preventive care. Studies will be also included if care that should be provided by a physician according to the applied guidelines was not yet provided until the mid-level provider was introduced. For example, regular screening of older people and providing health education.

Types of outcomes

- Patient outcomes: morbidity, mortality, hospital admission, nursing home admission, patient satisfaction, quality of life, patient compliance, knowledge, preference for physician or mid-level provider, health status;
- Process of care outcomes: patient safety, quality of healthcare, adherence/compliance to guidelines/protocols, healthcare activities (examination, provision of advice etc.);
- Care provider (physician, NP, PA, and nurse) outcomes: workload (objective and subjective), job satisfaction;
- Costs and cost effectiveness.

Relevant data on the facilitators and barriers to the implementation of physician substitution will be collected.

Exclusion criteria:

- Qualitative studies, letters, editorials, reviews or meta-analysis;
- Studies on supplementation by mid-level providers in healthcare for older people;
- Hospital care (including emergency department) and extended hospital care (hospital care provided in primary care facilities);
- Care provided by a multidisciplinary team which includes professionals besides the participants of our interest;
- Care provided by trainees.

Search methods

The following databases will be searched: PubMed, EMBASE, CINAHL, PsycINFO, Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science, from January 1990 to August 2015. The databases will be searched for articles in English and Dutch. As the term substitution or skill mix is not commonly used in articles on this subject, the search strategy to identify relevant studies will be as extensive as possible. It will comprise the following four sets: skill mix, nurse or physician assistant, setting, and patient population. The terms within a set will be combined with OR and the sets will be combined with AND. For each database, a specific search strategy will be developed. In PubMed terms will be combined as MESH and Title/Abstract (see Table 1), in EMBASE and PsycINFO as Subject Headings and Keywords, in CINAHL as Subject Headings and Title/Abstract, in CENTRAL as MeSH and Title/Abstract/Keyword, and in Web of Science as Topic. Furthermore, Google Scholar (www.scholar.google.com) will be searched.

The reference list of the selected articles will be searched to identify additional references and a cited reference search of the selected articles in Web of Science will be performed. Process descriptions of selected studies will be identified to identify relevant data on facilitators and barriers to the implementation of substitution of physicians by mid-level providers.

Selection of relevant papers

References found will be entered in EndNote. The first 100 hits of PubMed (sort by relevance) will be reviewed on title and abstract by all five reviewers (MLo, LB, AvV, AP, MLa). These selections will be compared and discussed to reach agreement. The other references will be reviewed by two independent reviewers (in different pairs: MLo, LB, AvV, AP, MLa). Subsequently, the eligible articles will be assessed on full text by two independent reviewers (in different pairs: MLo, AvV, AP, MLa). In case of discrepancies, consensus will be sought between the reviewers by discussion, or when consensus is not reached a third reviewer (MLa or AP) will be contacted

Data abstraction

A data extraction form will be developed and tested for this review. Study design, methods, participants, intervention, outcomes and results will be extracted. From each paper the data will be extracted by two independent reviewers (in different pairs: MLo, AvV, AP, MLa). Differences will be resolved by discussion, or a third reviewer (MLa, AP) will be contacted. Missing information will be retrieved from the corresponding author of an article.

Table 1 PubMed search strategy

Skill mix		
• "Professional Role"(Mesh)	• team*(Title/Abstract)	• interprofessional*(Title/Abstract)
• "Professional Autonomy"(Mesh)	• skills mix*(Title/Abstract)	• inter professional*(Title/Abstract)
• "Professional Competence"(Mesh)	• skill mix*(Title/Abstract)	• multiprofessional*(Title/Abstract)
• "Cooperative Behavior"(Mesh)	• skillmix*(Title/Abstract)	• multi professional*(Title/Abstract)
• "Patient Care Team"(Mesh:NoExp)	• practice redesign(Title/Abstract)	• interdisciplin*(Title/Abstract)
• role*(Title/Abstract)	• system redesign(Title/Abstract)	• inter disciplin*(Title/Abstract)
• professional autonom*(Title/Abstract)	• deleg*(Title/Abstract)	• multidisciplin*(Title/Abstract)
• professional competence*(Title/Abstract)	• substitut*(Title/Abstract)	• multi disciplin*(Title/Abstract)
• clinical competence*(Title/Abstract)	• shift*(Title/Abstract)	
• cooperat*(Title/Abstract)	• supervis*(Title/Abstract)	
• collaborat*(Title/Abstract)	• comanagement*(Title/Abstract)	
	• co management*(Title/Abstract)	
Nurse, nurse practitioner, or physician assistant		
• "Specialties, Nursing"(Mesh)	• nursing role*(Title/Abstract)	• physician's extender*(Title/Abstract)
• "Nurses"(Mesh)	• nursing discipline*(Title/Abstract)	• physicians' extender*(Title/Abstract)
• "Nurse's Practice Patterns"(Mesh)	• nursing staff(Title/Abstract)	• feldsher*(Title/Abstract)
• "Nurse's Role"(Mesh)	• nurse*(Title/Abstract)	• advanced practitioner*(Title/Abstract)
• "Physician Assistants"(Mesh)	• physician assistant*(Title/Abstract)	• specialist practitioner*(Title/Abstract)
• nursing specialt*(Title/Abstract)	• physicians assistant*(Title/Abstract)	• non physician*(Title/Abstract)
• advanced practice nursing(Title/Abstract)	• physician's assistant*(Title/Abstract)	• nonphysician*(Title/Abstract)
• advanced nursing practice(Title/Abstract)	• physicians' assistant*(Title/Abstract)	• mid level*(Title/Abstract)
• nursing specialist*(Title/Abstract)	• physician extender*(Title/Abstract)	• midlevel*(Title/Abstract)
• specialist nursing(Title/Abstract)	• physicians extender*(Title/Abstract)	
Patient population		
• "Aged"(Mesh)	• "Geriatric Psychiatry"(Mesh)	• frail*(Title/Abstract)
• "Geriatrics"(Mesh)	• aged(Title/Abstract)	• senior*(Title/Abstract)
• "Geriatric Assessment"(Mesh)	• geriatric*(Title/Abstract)	• pensioner*(Title/Abstract)
• "Homes for the Aged"(Mesh)	• geronto*(Title/Abstract)	• nursing home patient*(Title/Abstract)
• "Housing for the Elderly"(Mesh)	• elder*(Title/Abstract)	• rehabilitation patient*(Title/Abstract)
• "Health Services for the Aged"(Mesh)	• old*(Title/Abstract)	• hospice patient*(Title/Abstract)
• "Geriatric Nursing"(Mesh)	• octogenarian*(Title/Abstract)	
	• nonagenarian*(Title/Abstract)	
	• centenarian*(Title/Abstract)•	

Table 1 *continued*

Setting		
• "Primary Health Care"(Mesh:NoExp)	• primary healthcare(Title/Abstract)	• community(Title/Abstract)
• "General Practice"(Mesh)	• primary health care(Title/Abstract)	• home care(Title/Abstract)
• "Residential Facilities"(Mesh)	• primary care(Title/Abstract)	• home healthcare(Title/Abstract)
• "Housing for the Elderly"(Mesh)	• general practice*(Title/Abstract)	• home health care(Title/Abstract)
• "Community Health Services"(Mesh:NoExp)	• family practice*(Title/Abstract)	• hospice*(Title/Abstract)
• "Community Mental Health Services"(Mesh)	• family medicine*(Title/Abstract)	• senior center*(Title/Abstract)
• "Home Care Services"(Mesh)	• resident*(Title/Abstract)	• senior centre*(Title/Abstract)
• "Hospices"(Mesh)	• assisted living(Title/Abstract)	• rehabilitat*(Title/Abstract)
• "Senior Centers"(Mesh)	• group home*(Title/Abstract)	• long term care(Title/Abstract)
• "Rehabilitation Centers"(Mesh:NoExp)	• halfway house*(Title/Abstract)	• long term healthcare(Title/Abstract)
• "Long-Term Care"(Mesh)	• homes for the aged(Title/Abstract)	• long term health care(Title/Abstract)
• care home*(Title/Abstract)	• home for the aged(Title/Abstract)	• longterm care(Title/Abstract)
• institutional care(Title/Abstract)	• nursing home*(Title/Abstract)	• longterm healthcare(Title/Abstract)
• institutional healthcare(Title/Abstract)	• intermediate care(Title/Abstract)	• longterm health care(Title/Abstract)
• institutional health care(Title/Abstract)	• intermediate healthcare(Title/Abstract)	• retirement home*(Title/Abstra
• adult family home*(Title/Abstract)	• intermediate health care(Title/Abstract)	
• rest home*(Title/Abstract)	• nursing facilit*(Title/Abstract)	
	• housing for the elderly(Title/Abstract)	

In addition, each article will also be reviewed on data about the implementation process of substitution. The articles will be screened on facilitators and barriers for the implementation of physician substitution. As stated above, process descriptions of selected studies will be identified to receive additional information about the implementation.

Quality appraisal

The methodological quality of the studies included will be assessed independently by two reviewers (in different pairs: MLo, AvV, AP, MLa) using the QualSyst tool for quantitative studies (40). This tool is developed to evaluate primary research papers from a variety of fields (40). It is a validated generic checklist consisting of 14 items with scores from 0-2 and the possibility to score 'not applicable'. Summary score will be calculated for each study by summing the total score obtained across the fourteen items and dividing them by the total possible score of 28. Items that will be rated 'not applicable' will be excluded from the calculation of the summary score. The summary score will then be calculated by summing up the total score obtained across the relevant items and dividing that by the total possible score (i.e., 28 - (number of 'not applicable' x 2)). Studies will not be excluded based on their score.

Data synthesis

The clinical and methodological diversity as well as the results of the included studies will be described and presented in tabular form. As the inclusion of studies in different settings, different countries, and with different care providers introduces heterogeneity,

and the inclusion of other designs than randomized controlled trials (RCTs) introduces bias, it is discouraged to apply meta-analysis (Higgins & Green 2011). A narrative summary based upon the size, direction, and statistical significance of the effects will be presented. Two independent reviewers (in different pairs: MLo, AvV, AP, MLa) will grade the evidence by using the Grade guidelines (41). Differences will be resolved by discussion, or a third reviewer (MLa, AP) will be contacted. These grades will be taken into account when interpreting the data. In addition, the found facilitators and barriers to the implementation of substitution in primary healthcare for older people and long-term care facilities will be described.

Ethical considerations

This study deals with secondary data from primary research studies and there are, therefore, no ethical issues of concern.

Validity and reliability

This systematic review will be conducted following the quality methods outlined in the Cochrane Handbook (37), like double independent data processing and assessment of risk of bias. The reporting will follow the PRISMA statement (38).

DISCUSSION

This study reviews the effects of substitution of physicians by mid-level providers in primary healthcare for older people and long-term care facilities. In addition information will be collected on the implementation process, including the facilitators and barriers. Information on the effects and implementation will be useful for care providers, managers, policy administrators, and researchers in their decisions why, when, and how to substitute physicians by mid-level providers. This review will be useful in organizing healthcare for older people in an optimal way from the patient perspective, the care provider perspective and the cost perspective.

In this review, healthcare for older people is defined as general practices, family medicine, long-term care facilities, home care services for older people, hospices and geriatric ambulatory rehabilitation centers. This broad definition of healthcare for older people is used because these are the places where most adults of 65 years and older will receive their medical and preventive care. Furthermore, all studies where nurses, NPs and PAs substitute physicians will be included. It is chosen to include these different care providers because they are most likely to substitute physicians. In summary, the different settings and different care providers will contribute to a complete overview of the effects of physician substitution in care for older people as it takes place in practice and informs us

about facilitators and barriers that influence the implementation of such care models in which mid-level providers are included.

As stated before, all comparative quantitative studies will be included because a first search showed few RCTs and even few non-randomized controlled trials (NRCTs), controlled before-after (CBA) studies, and interrupted time series (ITS) studies. Although the inclusion of other designs than RCTs includes bias, it is chosen to include these studies to learn as much as possible from the current stage of knowledge on the effects of physician substitution in healthcare for older people. In addition, the inclusion of other designs than RCTs will contribute to the inclusion of more studies and all these studies will contribute to the second aim of this study: information on facilitators and barriers to the implementation of physician substitution in primary healthcare for older people and long-term care facilities.

Limitations

The inclusion of studies in different settings, in different countries, with different mid-level providers, and with different designs makes it impossible to perform a meta-analysis. However, development of a qualitative description of the studies and their results will provide an overview of the current available evidence. Furthermore, in many studies the role of physician substitutes is not described profoundly, which will make it hard to discern substitution from supplementation interventions. Nevertheless, contact with authors about the role of the mid-level provider will help to overcome this potential limitation. At last, it might be that there is little available evidence on some types of outcomes or on the implementation process. If this is the case, this review will show the areas on which more research is needed.

CONCLUSION

At completion, this review will report current evidence on the effects, facilitators, and barriers of physician substitution by mid-level providers in primary healthcare for older people and long-term care facilities. This information will contribute to the knowledge on effective care models that can be implemented in healthcare for older people.

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CHAPTER 3

3

Effects of substituting nurse practitioners, physician assistants or nurses for physicians concerning healthcare for the aging population: a systematic literature review

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Abstract

Aims: To evaluate the effects of substituting nurse practitioners, physician assistants or nurses for physicians in long-term care facilities and primary healthcare for the aging population (primary aim) and to describe what influences the implementation (secondary aim).

Background: Healthcare for the aging population is undergoing major changes and physicians face heavy workloads. A solution to guarantee quality and contain costs might be to substitute nurse practitioners, physician assistants or nurses for physicians.

Design: A systematic literature review.

Data Sources: PubMed, EMBASE, CINAHL, PsycINFO, CENTRAL, Web of Science; searched January 1995–August 2015.

Review Methods: Study selection, data extraction and quality appraisal were conducted independently by two reviewers. Outcomes collected: patient outcomes, care provider outcomes, process of care outcomes, resource use outcomes, costs and descriptions of the implementation. Data synthesis consisted of a narrative summary.

Results: Two studies used a randomized design and eight studies used other comparative designs. The evidence of the two RCTs showed no effect on approximately half of the outcomes and a positive effect on the other half of the outcomes. Results of eight other comparative study designs point toward the same direction. The implementation was influenced by factors on a social, organizational and individual level.

Conclusion: Physician substitution in healthcare for the aging population may achieve at least as good patient outcomes and process of care outcomes compared with care provided by physicians. Evidence regarding resource use and costs is too limited to draw conclusions.

INTRODUCTION

Healthcare for the aging population is undergoing major changes in developed countries due to population aging (1), increased multi-morbidity (2) and reforms that shift care from hospitals and long-term care facilities to the community (3). Most older adults live at home or in long-term care facilities, where a primary care physician (e.g. general practitioners, primary care geriatricians, or nursing home physician specialists (4)) is responsible for their medical care. These physicians face heavy workloads (5, 6). Besides, relatively few medical students are pursuing careers in healthcare for the aging population (4, 7, 8). Innovative solutions are needed to guarantee the quality and accessibility of healthcare for the aging population and to contain costs. A solution might be shifting some of the caregiving workload from physicians to nurse practitioners (NPs), physician assistants (PAs) or qualified nurses (9, 10).

Background

NPs, PAs or nurses may work as a physician substitute or as a physician supplement (11, 12). NPs, PAs or nurses working as a substitute provide the same services as the physicians, while those working as supplemental caregivers provide additional services which complement or extend those provided by the physician. Several reviews of substitution of NPs, PAs or nurses for physicians in long-term care facilities and primary healthcare have been performed (13-22). However, they were not limited to older adults, made no distinction between the substitute and supplement roles and were restricted to the nursing profession. Besides that, knowledge of the barriers to and facilitators of substituting for physicians' care in long-term care facilities and primary healthcare for the aging population is lacking. Although NPs, PAs or nurses working as supplements to primary care physicians in long-term care facilities and primary healthcare may also be valuable (23), the current review focused on the impact and implementation of NPs, PAs or nurses working as substitutes because this may be an answer to the major challenges in these settings (24).

THE REVIEW

Aims

The primary research question of this review is 'What effects are found in the literature on patient outcomes, process of care outcomes, care provider outcomes and costs of substitution of nurse practitioners, physician assistants or nurses for physicians in long-term care facilities and primary healthcare for the aging population, compared with the effects of care provided by physicians only?' The secondary research question is 'Which

barriers to and facilitators of the implementation of substitution of NPs, PAs or nurses for physicians in these settings are described in the literature?'

Design

This study is a systematic literature review reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (25) as described in the Cochrane Handbook (26). For background and an extensive method section we refer readers to the study protocol (24) and the PROSPERO database of the Centre for Reviews and Dissemination, CRD42015024586. This review is not a registered Cochrane review as we wished to provide a broad insight in the current state of evidence on this topic by including not only randomized controlled trials (RCT) but other comparative studies as well. Evidence from RCTs that meet the Cochrane criteria is distinguished from the 'wider evidence' of comparative studies in the presentation of results and discussion. Funding of the review (project number: 321580) was confirmed in August 2013 by the Ministry of Health, Welfare and Sport of the Netherlands.

Search methods

The following databases were searched: PubMed, EMBASE, CINAHL, PsycINFO, CENTRAL and Web of Science, from January 1995–August 2015. The databases were searched for articles in English. The reference lists of the selected articles were searched to identify additional articles and a cited reference search of the selected articles was performed in Web of Science. The search strategy used the following four sets of synonyms: skill mix, nurse or physician assistant, setting and patient population.

Inclusion and exclusion criteria

We applied detailed inclusion and exclusion criteria concerning types of studies, settings, participants, interventions, comparisons and outcomes.

Types of studies

All original research studies with a comparative quantitative evaluation design were included, such as RCTs, pre-postdesign studies and cohort studies with more than one group. We excluded non-comparative studies.

Types of settings

Settings included were: general practices, long-term care facilities, home care or community services for the aging population, hospices and geriatric ambulatory rehabilitation centers. We excluded hospital care or transferred hospital care.

Types of participants

- All patients ≥65 years old, or with a mean age of ≥70 years;
- Nurses, namely any qualified nurse working as a substitute for a physician, including, advanced practice nurses (APNs, NPs, clinical nurse specialists), geriatric nurses, district nurses, community nurses, health visitors, or practice nurses;
- PAs working as a substitute for a physician;
- Physicians, namely general practitioners, family physicians, internists, primary care geriatricians and nursing home physician specialists.

Types of interventions and comparisons

Comparisons of medical or preventive medical care for older patients by NPs, PAs or nurses with care as usual where no NP, PA or nurse was involved:

- Care provided by a physician/physicians compared with the same care provided by (a) NP(s), PA(s) or nurse(s);
- Care provided by (a) physician(s) compared with the same care provided by a team of a physician/physicians and (a) NP(s), PA(s) or nurse(s);

The care provided comprised medical and/or preventive medical care. Studies were also included if care that should be provided by a physician according to the applied evidence based guidelines was not yet provided according to the guidelines until the NP, PA or nurse was introduced.

Types of outcomes

- Patient outcomes: morbidity, mortality, patient satisfaction, health status, quality of life, patient compliance, knowledge, preference for physician or NP, PA or nurse;
- Process of care outcomes: patient safety, quality of healthcare, adherence and compliance to guidelines and protocols,
- Care provider outcomes: workload (objective and subjective), job satisfaction;
- Resource use outcomes: medication use, tests and investigations, use of services such as acute 'unplanned' visits, hospital admissions, etc.;
- Costs and cost effectiveness.

Search outcome

The initial search identified 19,991 papers that were possible candidates for review (see Figure 1). After removing duplicates 11,340 papers remained and were screened by two independent reviewers (different pairs: MLo, LB, AvV, AP, MLa) based on their titles and abstracts, using the inclusion and exclusion criteria. This resulted in 105 articles that appeared to meet the criteria. The full text of those articles was then assessed by two independent reviewers (different pairs: MLo, AvV, AP, MLa). For both selection of papers and assessment of full text papers, in case of discrepancies consensus was sought between the two reviewers by discussion, or when consensus was not reached a third

reviewer (MLa or AP) was contacted. Reference tracking and a cited reference search of the included articles resulted in three additional articles. Finally, 16 articles describing 12 studies were included.

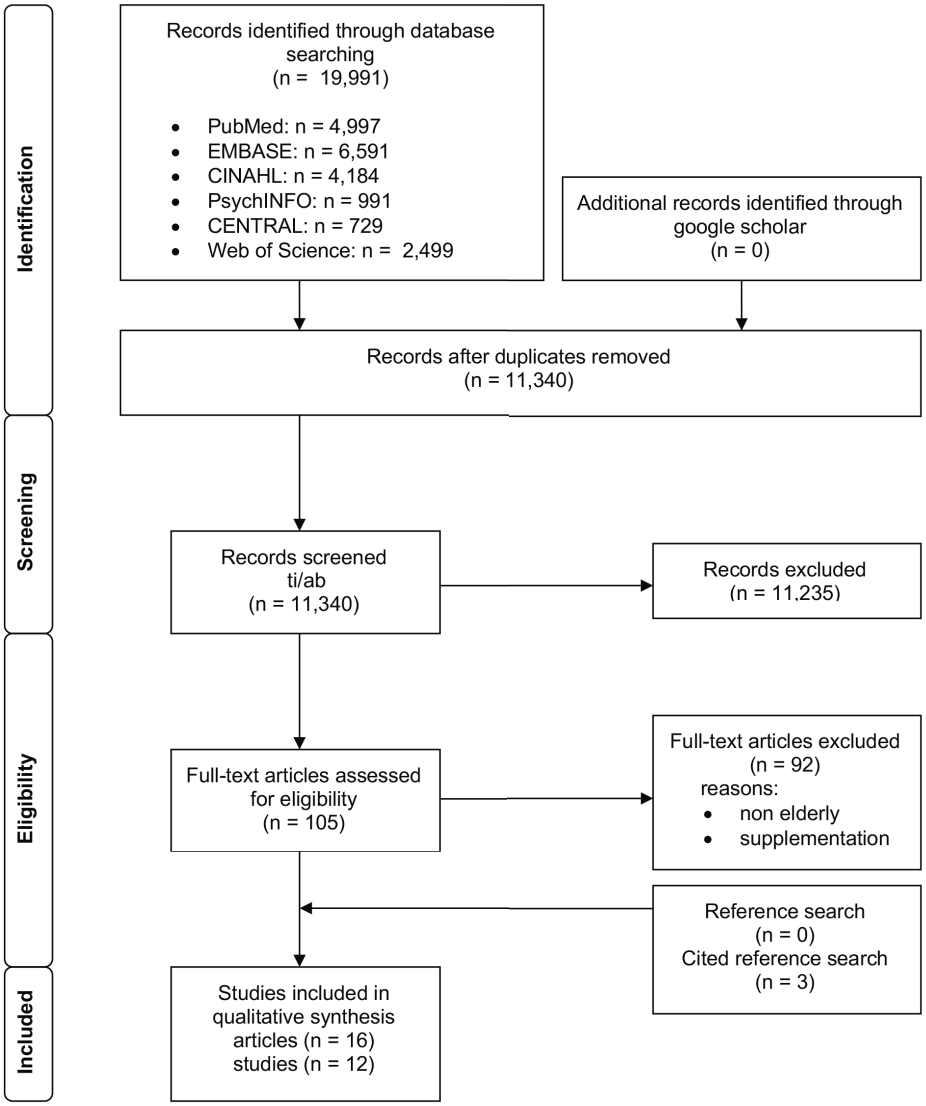

Figure 1 Flow diagram
Based on Moher et al. (25)

Quality appraisal

In addition to the original study protocol, we assessed the methodological quality of the RCT studies by the Cochrane risk of bias tool (26). To assess the methodological quality of the other studies, Cochrane recommends the risk of bias tool for non-randomized studies ROBINS-I tool (27). However, this tool lacked a meticulous guidance at the time this review was conducted in contrast with the QualSyst tool which was applied as it provided an extensive guidance on how to evaluate different items (28). The QualSyst tool encompasses a description of calculating a summative score as well. Conversely, the use of summative scores for assessing quality or risk of bias is discouraged in Cochrane reviews, because: a) they have shown to be unreliable assessments of validity; b) it is difficult to justify the weights assigned to different items in a scale; and c) scales are less likely to be transparent to users of the review (26). Nonetheless, it is also important to only include studies of sufficient quality, especially for non-randomized studies of which quality may vary dramatically. Therefore, the QualSyst tool was applied to define a minimum methodological quality threshold for study inclusion and to exclude those from the analysis of effects (research question one). A score higher than 0.5 was defined as a study with adequate quality (28). The methodological quality of the studies was assessed independently by two reviewers (in different pairs: MLo, AvV, AP, MLa). Results pertaining to the effect of the intervention will be presented as 'Evidence, based on RCTs' and as 'Wider evidence, based on non-randomized studies'.

Data abstraction

Study design, methods, participants, intervention, outcomes, results and implementation barriers and facilitators were identified by two independent reviewers (in different pairs: MLo, AvV, AP, MLa). Differences were resolved by discussion, or a third reviewer (MLa or AP) was contacted. Missing information was retrieved from the corresponding author in six cases.

Data synthesis

To answer our primary research question, we only included studies with a quality score higher than 0.5 and which reported the outcomes of statistical analysis. Because of the heterogeneity of included studies such as different settings, different countries, different care providers, different outcome measures and the bias related to the inclusion of designs other than RCTs, it was not possible to conduct a meta-analysis (26). Therefore, the results of this systematic literature review are presented in tabular form and for each setting a narrative summary based on the size, direction and statistical significance of the effects is presented. In addition, the identified barriers to and facilitators of physician substitution in healthcare for the aging population are described.

Note that in our initial protocol, it was planned to grade the evidence by using the GRADE guidelines (29). The GRADE guidelines grade the quality of the results of a meta-analysis, for example by means of its precision and consistency. Because no meta-analysis was performed, we contacted the first author of the GRADE articles who suggested using the confidence intervals of each individual study to grade the evidence. However, this was also not possible, as most papers in this review did not report a mean or relative risk with a confidence interval, nor could it be calculated, as the number of patients was not reported (30, 31). In conclusion, it was impossible to grade the evidence according to the GRADE guidelines.

RESULTS

Characteristics of studies

For detailed characteristics of the studies, see Table 1 and for additional description of the intervention,see Additional Table S1. The 12 included studies showed a range of study designs: two RCTs (one using a post-test only design), three pre-test posttest designs without a separate comparison group, one posttest only with two groups design and six studies using a historical cohort with a two or three groups design. Year of publication varied from 1997 - 2015. Most studies were conducted in the USA, followed by one study from Canada, one from Sweden and one from Japan. Mean age of the older adults varied from 72 years to 86.3 years. Sample size varied from 114 – 2,575.

Seven studies took place in long-term care facilities and nursing homes. In five of these studies the care provider was an NP, in one a PA and in one study both an NP and a PA were deployed. The other five studies were performed in primary healthcare settings. In three of these studies the care provider was an NP, in one a nurse and in one study both an NP and a PA were deployed. Four out of 12 studies reported on the effects on patient outcomes, six on process of care outcomes, none on care providers' outcomes, six on resource use outcomes, two on costs and seven on implementation.

Table 1 Characteristics of studies

Author Year Country	Design (duration)	Setting Participants	Physicians, NPs, PAs, or nurses	Control group	Intervention group
LONG-TERM CARE FACILITIES					
Abdallah et al. (36) 2015 USA	Historical cohort with three groups (3 years, 2006-2008)	Nursing homes: n=? Nursing home patients n=319 CG n=197, IG n=57	Physicians: n=? NPs, PAs: n=?	Physician only care	NP/PA-dominant care
Ackermann and Kemle (30) 1998 USA	Pre-test post-test without a comparison group (6 years, 1992-1997)	Nursing home: n=1 Nursing home patients: n=250 (92 beds)	Faculty physicians at a family practice residency: n=5 to 6 Family practice residents: n=? PA: n=1	Physician and resident care	Physician and PA care
Aigner et al. (39) 2004 USA	Historical cohort with two groups (1 year,1997-1998)	Nursing homes: n=8 Nursing home patients: n=203 CG n=71, IG n=132	Physicians of a large teaching hospital: n=? Adult NP: n=1, Family NP: n=2	Physician only care	NP and physician care
Burl et al. (44) 1998 USA	Historical cohort with two groups (1 year, 1995)	Long-term care facilities: n= >45? Residents of the long-term care facilities: n=1,077 CG n=663, IG n=414	Physicians: n=? Geriatric NPs: n=10?	Physician only care	NP and physician care
Johnson (35) 1997 USA	Historical cohort with two groups (1 year, 1995-1996)	Nursing homes: n=10 Nursing home patients: n=528 CG n=273, IG n=255	Geriatricians, family practitioners, internists: n=? NPs: n=?	Physician only care	NP and physician care
Klaasen et al. (31) 2009 Canada	Pre-test post-test without a comparison group (2-years, 2006-2007, 2007-2008)	Nursing home: n=1 Nursing home patients: n=114/116?	Physicians: n=3 NP: n=1	Physician only care	NP and physician care
Ono et al. (43) 2015 Japan	Pre-test post-test without a comparison group (4 years, 2009-2011, 2011-2013)	Nursing home: n=1 Nursing home patient: n=479 CG n=260, IG n=219	Full-time physician: n=1 NP: n=1	Physician only care	NP and physician care
PRIMARY HEALTHCARE					
Agvall et al. (32, 33) 2013, 2014 Sweden	Randomized controlled trial with two groups (1 year)	Primary healthcare centers: n=5 HF patients: n=160 CG n=81, IG n=79	GPs: n=2 HF nurses: n=5	Physician only care	Nurse and physician care
Cardozo et al. (40, 41) 1998 USA	Historical cohort with two groups (2 years)	Ambulatory care clinics: n=2 Patients of the ambulatory care clinics: n=243 CG n=111, IG n=132	Geriatricians and MRs: n=? NPs specialized in geriatric medicine: n=3	MR and physician care	NP and physician care

Table 1 *continued*

Everett et al. (37, 38, 59) 2013, 2014 USA	Historical cohort with three groups (1 year, 2008)	Internal medicine, family practice, and geriatric primary care clinics: n=32 Patients with diabetes: n=2,575 CG n=1,009 , IG n=127	Attending physicians: n= 210 Residents physicians: n=51 PAs: n=24 NPs: n=28	Usual provider physician	Usual provider NP/PA
Ganz et al. (34) 2010 USA	Randomized post-test only with two groups (13 months, 2006-2007)	Outpatient clinic: n=1 Office located in the community: n=1 Patients of the practices: n=200 CG n=92, IG n=108	Geriatricians: n=18 NP: n=1	Physician only care	Physician and NP care
Reuben et al. (42) 2013 USA	Post-test only with two groups (9 months, 2009-2010)	Community based primary care practice: n=2 Patients of the practices: n=485 CG n=247, IG n=238	Physicians: n=12 NPs: n=2	Physician only care	Physician and NP care

GP = general practitioner, HF = heart failure, IG = intervention group, MD = doctor of medicine, MR = medicine resident, NP = nurse practitioner, PA = physician assistant

Quality of studies

Table 2 describes the methodological quality of the two included RCTs. The category risk of other sources of bias scored unclear in the study of Agvall et al. (32, 33) and high in the study of Ganz et al. (34) for several reasons, including the fact that one pair of physicians switched intervention/control group status and the fact that there was an uncorrected difference between the intervention and control group at baseline. The methodological quality of the other comparative studies is at risk of bias just because they are not of a randomized design (26). The risk of bias measured by the QualSyst tool varied from 0.23 to 0.77 (Table 3). Reported outcomes that were not statistically analyzed were not described in this review. Two studies scored lower than 0.5 and were excluded from analyzing the effect of substitution.

Table 2 Cochrane Collaboration's tool for assessing risk of bias (Higgins & Green 2011)

Studies	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other sources of bias
PRIMARY HEALTHCARE							
Agvall et al. (32, 33)	-	-	+	?	-	?	?
Ganz et al. (34)	-	?	+	+	-	?	+

- = low risk
+ = high risk
? = unclear risk

Table 3 Quality assessment with the QualSyst tool for quantitative studies (Kmet *et al.* 2004)

Studies	1. Question	2. Study design	3. Selection	4. Subject characteristics	5. Random allocation	6. Blinding investigators	7. Blinding subjects	8. Outcome	9. Sample size	10. Analytic methods	11. Estimate of variance	12. Confounding	13. Results	14. Conclusion	Summary score
LONG-TERM CARE FACILITIES															
Aigner et al. (39)	2	1	1	1	n/a	n/a	n/a	2	1	2	1	0	2	2	15/22 = 0.68
Johnson (35)	2	1	2	1	n/a	n/a	n/a	2	2	2	0	1	2	2	17/22 = 0.77
Ono et al.(43)	2	1	2	2	n/a	n/a	n/a	2	2	2	0	0	2	1	16/22 = 0.73
Abdallah et al. (36)	2	1	1	2	n/a	n/a	n/a	1	1	2	0	2	2	1	15/22 = 0.68
Ackermann and Kemle (30)	2	1	2	1	n/a	n/a	n/a	2	1	1	0	0	2	1	13/22 = 0.59
Burl et al. (44)	1	1	0	0	n/a	n/a	n/a	1	2	0	0	0	1	1	7/22 = 0.32*
Klaasen et al. (31)	0	0	1	0	n/a	n/a	n/a	1	1	0	0	0	1	1	5/22 = 0.23*
PRIMARY HEALTHCARE															
Cardozo et al. (40/41)	2	1	1	2	n/a	n/a	n/a	2	1	2	0	0	1	2	14/22 = 0.64
Everett et al. (37, 38, 59)	2	1	0	1	n/a	n/a	n/a	2	1	2	2	2	2	0	15/22 = 0.68
Reuben et al. (42)	2	2	2	0	0	0	n/a	2	2	2	0	2	2	1	17/26 = 0.65

The summary score of the QualSyst tool was calculated by summing up the total score obtained across the relevant items and dividing that by the total possible score, i.e. 28 – (number of 'not applicable' x2).
2 = yes
1 = partial
0 = no
n/a = not applicable
* Poor methodological quality, excluded from the analysis of effects

Evidence of two RCTs

Two studies in primary healthcare met the Cochrane criteria (32-34). Their results are described below (Table 4 and Additional Table S2).

Effects on patient outcomes

In the study of Agvall et al. (32, 33) a composite endpoint was calculated for heart failure patients with a higher score for positive outcomes. This composite endpoint included the following outcomes: changes in ejection fraction (EF), N-terminal pro brain natriuretic peptide (NT-proBNP) levels, quality of life, hospital admissions and mortality. The intervention improved the composite endpoint of heart failure patients from -37 to 25 (p=0.01). At the start of the study there was no significant difference in the number

Table 4 Outcomes

Outcome	Study	Measurement	Control group	Intervention group	Variance around the difference	P value
LONG-TERM CARE FACILITIES						
Patient outcomes	Abdallah et al. (36)	• Health status and functional ability: *Linear models* Orientation: Activities of daily living: *Logistic models/Linear models* 14 other measurements (see additional table 2):	 ß: -0.323 ß: -0.449 -	 Reference group Reference group -	 NR NR -	 0.02 0.04 NS
	Johnson (35)	• Mortality (deaths)	72 (28%)	59 (24%)	NR	0.28
Care provider outcomes	-	-	-	-	-	-
Process of care outcomes	Aigner et al. (39)	• Completion of mandatory progress visits (per patient per year): • Completion of annual mandatory histories and physical examinations (of the time):	4.5 (SD 2.7) 78%	4.6 (SD 3.1) 81%	NR NR	NS 0.66
Resource utilization outcomes	Ackermann and Kemle (30)	• Hospital admissions (per 1000 patient years):	598	371	NR	0.03
		• Hospital days (per 1000 patient years):	4,170	1310	NR	<0.001
	Aigner et al. (39)	• Medications (per month): • Emergency department visits (patients with at least one visit): • Hospital admissions (patients with at least one admission): • Acute 'unplanned' consultations by provider in nursing home (per patient per year):	6.2 (SD 3.1) 29 (63%) 17 (37%) 1.2 (SD 1.5)	6.4 (SD 3.7) 59 (58%) 36 (35%) 3.0 (SD 2.4)	NR NR NR NR	0.73 0.60 0.85 <0.0001
	Johnson (35)	• Hospital admissions (patients with a least one admission):	42 (24%)	30 (16%)	NR	0.06
	Ono et al. (43)	• Emergency ambulance transfers (patients): • Hospital admissions (patients):	19 (7%) 119 (46%)	5 (2%) 66 (30%)	NR NR	0.006 0.001
Costs	Aigner et al. (39)	• Costs of emergency department visits (per patient per year, $): • Cost of hospital admissions (per patient per year, $):	229 (SD 397) 1,518 (SD 2,876)	292 (SD 535) 2,619 (SD 6,371)	NR NR	0.91 0.77

Table 4 *continued*

PRIMARY HEALTHCARE						
Patient outcomes	Agvall et al. (32, 33)	• Composite endpoint (changes in EF, NT-proBNP concentration, quality of life, and hospital admissions and mortality, see additional table 2):	-37	25	NR	0.01
		• Changes of EF (number of patients with an EF <40%):	44 (63%)	39 (55%)	NR	0.34
		At the start of the study:	45 (64%)	33 (46%)	NR	0.03
		At the end of the study:				
		• Changes of NT-proBNP concentration (median ng/L):	588 (IQR 1137)	1091 (IQR 1734)		
		At the start of the study:	671 (IQR 1234)	895 (IQR 1354) (p=0.01)	NR	NR
		At the end of the study:	(p=0.5)	-		
			-		-	NS
		• Changes of quality of life measurements (difference in between CG and IG, see additional table 2):	0.65	0.66		
		• QALYs (mean)	0.60 (NS)	0.62 (NS)	NR	NR
		At the start of the study:				
		At the end of the study:				
	Everett et al. (37, 38, 59)	• Mean HbA1c: 7-9:	Reference group	OR 1.52	95% CI 0.97-2.37	0.07
					95% CI 0.51-1.95	
		• Mean HbA1c: >9:	Reference group	OR 1.00		0.99
Care provider outcomes	-	-	-	-	-	-

Process of care outcomes	Agvall et al. (32, 33)	• Patients on treatment with renin-angiotensin system blockade	67 (83%)	62 (78%)	NR	0.50
		At the start of the study:	68 (84%)	79 (100%)	NR	0.002
		At the end of the study:				
		• Patients on treatment with beta-blockers	61 (75%)	54 (68%)	NR	0.33
		At the start of the study:	63 (78%)	58 (73%)	NR	0.52
		At the end of the study:				
		• Dosage of medication (mean percentage of the optimal dosage)	69%	94%	NR	<0.001
		Renin-angiotensin system blockade:	36%	46%	NR	0.10
		Beta-blockers:				
	Cardozo et al. (40, 41)	• Secondary prevention performance rate (overall rate):	36.9%	84.5%	NR	<0.001
	Everett et al. (37, 38, 59)	• 2 or more HbA1c tests:	Reference group	OR 0.7	95% CI 0.47-1.19	0.22
	Ganz et al. (34)	• Total Quality of care (completion of care processes specified by relevant ACOVE-3 QI):	34%	54%	NR	<0.001
	Reuben et al. (42)	• Total Quality of care (completion of care processes specified by relevant ACOVE-3 QI):	35%	71%	NR	<0.001
Resource utilization outcomes	Agvall et al. (32, 33)	• Emergency department visits (not resulting in admittance):	11 (n=73)	2 (n=71)	NR	0.001
			51 (n=73)	36 (n=71)	NR	0.03
		• Hospital admissions (number):	5.2	3.4	NR	0.16
		• Hospital days (per patient):	6.8 (SD 13.6)	3.9 (SD 10.3)	NR	0.13
		• Number of outpatient contacts (per patient):	17.5 (SD 19.4)	12.4 (SD 12.0)	NR	0.05
		• Number of primary healthcare contacts (per patient):	24.2 (SD 28.7)	16.3 (SD 18.0)	NR	0.04
		•Number of contacts for outpatient contacts and primary healthcare contacts (per patient):				
	Everett et al. (37, 38, 59)	• Number of visits to the emergency department:	Reference group	OR 1.5	95% CI 1.06-2.03	0.02
					95% CI 0.7-1.59	
		• Number of hospital admissions:	Reference group	IRR 1.1		0.64
Costs	Agvall et al. (32, 33)	• Costs (hospital care, primary healthcare and medication, per patient per year, EUR):	6,638	4,471	NR	0.01

ACOVE-3 QI = Assessing Care of Vulnerable Elders-3 quality indicators, NR = not reported, NS = not significant, QALYs = quality-adjusted life years, Shaded area = evidence of RCT

of patients with an EF < 40%, in both groups. However, after the intervention there was a difference in favor of the intervention; 33 patients compared with 45 in the control group (p=0.03) had an EF < 40%. The change in NT-proBNP level before and after the intervention was significant in the intervention group; it decreased from 1091 ng/L to 895 ng/L (p=0.01). There was no significant before/after difference in the control group (588 vs. 671 ng/L (p=0.5)). No significant difference in change of quality of life scores was found between the groups. Agvall et al. (32, 33) also found that the average patient quality-adjusted life years in both the control group and the intervention group did not significantly change during the course of the study.

Effects on process of care outcomes

Agvall et al. (32, 33) found that before the intervention, there was no significant difference in the number of heart failure patients on treatment with renin-angiotensin system blockade between the control group and the intervention group. After the intervention there were 68 patients on treatment with renin-angiotensin system blockade in the control group compared with 79 in the intervention group (p=0.002). There was no significant difference in the number of patients on treatment with beta-blockers between the control group and the intervention group either before or after the intervention. The same study reported that for patients in the intervention group the percentage mean dosage of renin-angiotensin system blockade of the optimal dosage was 94% compared with 69% in the control group (p<0.001). There was no significant difference in the percentage mean dosage of beta-blockers of the optimal dosage (32, 33). Ganz et al. (34) found a higher score on the Assessing Care of Vulnerable Elders-3 (ACOVE-3) quality indicators in favor of the intervention, 54% compared with 34% in the control group (p<0.001).

Effects on care provider outcomes

No outcomes were reported in the included studies pertaining to the effect of NPs, PAs or nurses on care provider outcomes.

Effects on resource use outcomes

Agvall et al. (32, 33) found that the number of emergency department visits (not resulting in admittance) was 11 in the control group and two in the intervention group (p=0.001). Agvall et al. (32, 33) reported that the number of hospital admission was lower in the intervention group, 36 versus 51 in the control group (p=0.03). Agvall et al. (32, 33) found no significant difference in the number of hospital admissions. Agvall et al. (32, 33) found no significant difference in hospital days, number of outpatient contacts and number of primary healthcare contacts. However, when the number of outpatient contacts and the number of primary healthcare contacts were combined, there were 16.3 per patient in the intervention group versus 24.3 per patient in the control group; the difference was significant (p=0.04) (32, 33).

Effects on costs

Agvall et al. (32, 33) found a reduction in the total costs (hospital care, primary healthcare and medication) for patients in favor of the intervention group. The costs were EUR 6,638 in the control group and EUR 4,471 in the intervention group (p=0.01) (32, 33).

Wider evidence of eight other comparative studies

Below, the results of the remaining eight studies are described See Table 4 and Additional Table S2 for all outcomes.

Effects on patient outcomes

Four studies reported on patient outcomes, two in long-term care facilities and two in primary care. In the following paragraphs, the effects are described for each setting. The outcomes reported were: mortality, health status and quality of life.

Long term care facilities

Mortality was assessed in one study that did not find a significant difference in the number of deaths (35).

One study found that patients' score for orientation decreased -0.323 on a scale from 0-4 (4=better orientation) for the control group compared with the intervention group (p=0.02), meaning that patients in the intervention group scored better on orientation (36). For activities of daily living patients' score decreased -0.449 on a scale from 0-6 (6=better functioning) for the control group compared with the intervention group (p=0.04), meaning that patients in the intervention group had better activities of daily living. On 14 other outcomes related to health status and functional ability no significant effects were found (36).

Primary healthcare

Everett et al. (37,38) found no significant difference in the mean HbA1c of patients with diabetes in the intervention group and the control group.

Effects on process of care outcomes

Four studies assessed process of care outcomes, one in long-term care facilities and three in primary healthcare. The outcomes reported were: adherence and compliance to guidelines and protocols and quality of healthcare.

Long-term care facilities

One study found that the number of mandatory progress visits per year was similar for both groups, 4.5 for the control group versus 4.6 for the intervention group (39). No

significant difference was found in the number of annual mandatory histories and physical examinations performed (39).

Primary healthcare

Cardozo et al. (40, 41) found a higher overall performance rate on secondary prevention performance in the intervention group, 84.5%, compared with the control group's 36.9% ($p<0.001$), which is a positive effect. Everett et al. (37, 38) found no significant difference between the intervention group and the control group in the number of patients with diabetes that received two or more HbA1c tests. One study found a higher score on the Assessing Care of Vulnerable Elders-3 (ACOVE-3) quality indicators in favor of the intervention, 71% versus 35% in the control group ($p<0.001$) (42).

Effects on care provider outcomes

No outcomes were reported in the included studies pertaining to the effect of NPs, PAs or nurses on care provider outcomes.

Effects on resource use outcomes

Five studies reported on resource use outcomes, four in long-term care facilities and one in primary healthcare. Outcomes reported were: number of medications used, number of acute 'unplanned' consultations by care provider in nursing home, number of emergency department visits, number of hospital admissions, hospital days, number of outpatient contacts and number of primary healthcare contacts.

Long-term care facilities

Aigner et al. (39) found no significant difference in average number of medications used by patients. The number of acute 'unplanned' consultations by care providers in nursing homes was higher in the intervention group, 3.0 per year, compared with 1.2 in the control group ($p<0.0001$) (39).

Two studies reported on number of emergency department visits. One found a reduction of the number in favor of the intervention, with 19 in the control group versus five in the intervention group ($p= 0.006$) (43). Another study showed no significant difference in number of emergency department visits (39).

The number of hospital admissions was assessed in four studies. Two studies found a significant reduction in favor of the intervention (30, 43). In the study of Ackermann and Kemle (30) the number was 598 per 1,000 patient years in the control group versus 371 per 1,000 patient years in the intervention group ($p=0.03$). In the study of Ono et al. (43) the number of hospital admissions was 119 in the control group versus 66 in the intervention group ($p=0.001$). Two other studies reported no significant difference in the number of

hospital admissions (35, 39). In addition, the number of hospital days decreased in the study of Ackermann and Kemle (30), from 4,170 per 1,000 patient years in the control group to 1,310 per 1,000 patient years in the intervention group ($p<0.001$).

Primary healthcare

Everett et al. (37, 38) found an incidence rate ratio of 1.5 for number of visits to the emergency department for the intervention group compared with the control group ($p=0.02$). Everett et al. (37, 38) found no significant difference in the number of hospital admissions.

Effects on costs

Costs were assessed in one study in long term care facilities and one study in primary healthcare.

Long-term care facilities

Aigner et al. (39) described no significant difference in emergency department costs and hospital admission costs between control group and intervention group.

Implementation

Seven studies reported on the implementation of substitution of NPs, PAs or nurses for physicians(see Additional Table S3). The information was sometimes described in the results section, but mainly in the discussion of the articles. In none of the studies was implementation an outcome measure in its own right. No process evaluations were found. Although in dditional Table S3 the barriers and facilitators are reported for each setting, due to the large overlap in barriers and facilitators we do not discuss this separately in the text below.

Barriers

Most barriers described were related to the funding of the NP and PA. Both fee-for-service and managed care have pros and cons; in both types of funding, structural funding of the NP and PA should be guaranteed (30, 44, 42). It was also reported that in some cases hospital care was more lucrative than nursing home care, which was a barrier to the deployment of NPs in nursing homes (35, 44). Other reported barriers were difficulties in the recruitment of a suitable NP, too limited knowledge of the NP and legislation that limited the scope of NPs (31). In addition, Aigner et al. (39) reported an organizational barrier, namely the fact that NPs rotated quarterly to one of three groupings of nursing homes. In three studies, physicians' unwillingness to share the responsibility of patient care was mentioned (31, 34, 42). Furthermore, a small minority of patients were reluctant to follow through on the NP referral (42).

Facilitators

In the study of Ganz et al. (34), the NP's co-management was supported by a special grant and in the study of Burl et al. (44), a new form of reimbursement was implemented to make nursing home care more lucrative than hospital care. In addition, the following organizational facilitators were described: 1) a run-in period for the NP (34); 2) support shown by the facility and regional leadership (31); 3) practice changes based on the best available evidence (31); and 4) a full-time job for the NP, so that she is on site 5 days a week (31). Moreover, several characteristics of the NP were important to successfully implement the NP: a pioneering spirit, ability to work independently, thirst for knowledge and willingness to shape her or his own practice (31). Johnson (35) emphasized the caring aspects of NPs; they might be more familiar than physicians with the type of comfort care that can be provided in the nursing home. In addition, the medical director's leadership and mentoring was important for successfully implementing the NP (31).

DISCUSSION

The evidence of two RCTs in primary healthcare showed no effect, which means that substitution of NPs, PAs or nurses for physicians produced results equal compared with physician only care for approximately half of the patient, process and resource use outcomes and it showed a positive effect in favor of substitution of NPs, PAs or nurses for physicians for the other half of these outcomes. This result was supported by wider evidence from eight other comparative studies, except for resource use outcomes; two of these studies showed a significant increase in number of acute 'unplanned' visits. Costs were assessed in two studies; the RCT showed significantly lower costs in the intervention group and in the other study there was no effect. None of the included studies reported care provider outcomes. Although the results of the comparative studies are mostly supportive of RCT results, without estimates of precision it is not possible to interpret these results due to incomplete reporting.

The effects found in this review are supported by previous reviews of substituting NPs, PAs or nurses for physicians in long-term care facilities and primary healthcare (13-22). Similar to the current review, previous reviews were limited by the quality of studies. Nevertheless, all reviews showed a similar direction of effects: substitution of NPs, PAs or nurses for physicians is feasible with at least maintenance of quality and no increase in costs.

An explanation why some studies found a positive effect of substituting NPs, PAs or nurses for physicians, while other studies did not might be found in the way it is organized, but a detailed description of the roles, tasks and responsibilities of NPs, PAs and nurses is

lacking in most of the papers. The results of current review show that the implementation of physician substitution is influenced by social, organizational and individual factors and these factors might also affect the impact of physician substitution. To successfully implement NPs, PAs or nurses in healthcare for the aging population several conditions on different levels should be met. First, at a societal level there should be appropriate funding, there should be enough NPs, PAs or nurses available, legislation should enable physician substitution and the curriculum of NPs, PAs or nurses should include geriatric care (30, 31, 34, 35, 42, 44). These findings are in line with a recent study published by Maier and Aiken (45), which studied the advanced nursing roles. They showed a diversity in how advanced practice was applied in different countries and is affected by amongst others financial arrangements, regulation and legislation,and education of care providers. Second, the organizational climate should support NPs, PAs or nurses expanding their role, for example with a facility leadership that challenges the status quo (31, 34, 39). Lastly, NPs, PAs and nurses should have a pioneering spirit and the physician should be willing to share the responsibility of patient care (31, 34, 42). Physicians might be unwilling to share responsibility because of a lack of understanding of the NP's, PA's or nurse's role, fear of malpractice, being held responsible for the actions of the NP, PA or nurse and fear of loss of professional identity or becoming less essential in healthcare for the aging population (9, 46, 47, 48). Trust and respect are important for a successful collaboration; this can be accomplished by communication and a collaborative agreement (46). In addition to the evidence regarding the barriers and facilitators from quantitative studies, a qualitative evidence synthesis could be carried out to gain more in-depth insight (49).

Although substituting NPs, PAs or nurse for physicians might be an answer to the major challenges faced in healthcare for the aging population, only more of the same will not be enough to provide good quality of healthcare for the aging population (1). The health and social needs of this population are often complex and long-term, but most healthcare systems are organized to diagnose and cure time-limited health issues. To overcome this problem, patient-centered and integrated care should be implemented (1). EverCare NPs in the United States, for example, reduced hospitalizations of nursing home patients by recognizing problems early and treating patients in the nursing home who might otherwise be sent to the hospital (23). Also in primary healthcare for the aging population, NPs, PAs and nurses provide proactive care. However, contrary to expectations, the effects of this proactive care strongly vary across studies (50-57). These mixed results might be related to the different goals and designs of proactive care. Future research should not solely focus on the substitute or supplemental role of NPs, PAs and nurses in healthcare for the aging population, but it should focus on how NPs, PAs and nurses can contribute the most to the quality of healthcare for the aging population as one of the professionals in a team with different competences.

Strengths and limitations

A strength of this review is that the search strategy was very meticulous and extensive and the tables in this review are extensive, informative and comprehensible. This review included not only RCTs but all studies with a comparative design as well which provides a broad insight in the current state of evidence on this relevant topic. Studies of low methodological quality were excluded from the effect evaluation which strengthens the result section. They were, however, included in the analysis of barriers and facilitators to provide insight in the current state of evidence on implementation of physician substitution.

Limitations of this review should be considered while interpreting the results. First, the aim was to only include studies that fully focused on the substitution role of NPs, PAs or nurses and although all designs in the included studies fulfill this inclusion criterion it cannot be ruled out that in real practice the NPs, PAs or nurses also performed supplemental roles. The division between substitute and supplemental roles has no clear cut off point and for the future it might be also interesting to focus on the integration of those two roles. Second, only two RCTs were included. Would this review have been a Cochrane review, only the evidence of these two studies would have been be included. Including and interpreting the evidence of eight studies with other comparative designs entails some limitations as these designs automatically imply higher risk of bias and might give a false representation of the effect, for example, most of those studies did not report confidence intervals. Despite this limitation, it is informative that 'the wider evidence' points toward the same direction as the evidence of the RCTs as most evidence showed an unambiguous view (no effect or a positive effect). Third, care provider outcomes were not reported in any of the studies and only two studies reported on costs. Fourth, despite differences in the wider context, physician substitution is an organizational intervention that is applied in many countries to maximize workforce capacity (45). So, we argue that despite differences between countries and type of care provider (58), the systematic approach applied in this review contributes to the knowledge of the impact of physician substitution across these differences. Fifth, the QualSyst tool for quantitative studies (28) did not address all aspects that are relevant for determining methodological quality; contamination and attrition bias are not included in this tool. Afterwards, we checked whether those types of bias were present. In two studies, there was a risk of contamination in such a way that the control group might have received the intervention, as the intervention and the control condition were provided in a long-term care facility or clinic at the same time (39, 42). For two other studies it is unclear whether there was a risk of contamination (35, 44). Furthermore, three studies reported missing participants (35, 37, 39), with 31 as the highest percentage (35). In three other studies it was unclear whether there were missing participants (36, 40, 44). Moreover, the risk of publication bias on the topic addressed in this review cannot be ruled out.

CONCLUSION

Substitution of NPs, PAs or nurses for physicians in long-term care facilities and primary healthcare for the aging population appears to achieve at least as good patient outcomes and process of care outcomes as care by physicians. However, this conclusion should be viewed with great caution given the fact that only two RCTs were included. The results of the other comparative studies seem to support the trial results, but their reliability is unclear due to incomplete statistical reporting. Evidence about resource use is ambiguous and evidence with regard to the costs of care is limited to two studies. Thus, we are unable to draw definite conclusions on costs of care. To successfully implement physician substitution in healthcare for the aging population, it is necessary that certain conditions on a social, organizational and individual level (patient and care provider) are met.

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Additional Table S1 Description of the intervention

Author Year Country	Intervention by control group and intervention group
LONG-TERM CARE FACILITIES	
Abdallah et al. (36) 2015 USA	*No information given on the provided care.* *Using Medicare data study participants data were divided into three categories or cohorts:* *Control:* MD-only: those who received primary care services within the nursing home exclusively from a physician. Intervention: NP/PA-dominant: those who received more than one half or their primary care visits from an NP or PA. Remaining group: MD-dominant: those who received primary care services from an NP or PA, yet those visits accounted for less than one half of total primary care visits.
Ackermann and Kemle (30) 1998 USA	*Control:* Physicians and residents each made monthly visits, and acute care was generally managed by physician telephone triage. *Intervention:* In may 1994 the PA began providing medical care in the nursing home. • The PA visited the facility three to four times (12-15 hours) every week, completed the initial history and physical examination on most new admissions, and reviewed them promptly with the attending physician. • The PA alternated routine monthly visits with the attending physician and provided nearly all acute care visits. • Telephone calls from the nursing home were directed to the PA during regular working hours, family practice resident physicians handled calls after hours and on weekends. The PA consulted daily with attending physicians and residents as appropriate and followed the progress of any hospitalized nursing home patients.

Aigner et al. (39) 2004 USA	*Control:* Physician only care. *Intervention:* Care provided by NP and physician. Each NP worked at one of three groupings of nursing homes and worked collaboratively with approximately 25 physicians. • The NP was responsible for most acute visits, every other mandatory progress visits, and performing annual histories and physical examinations (if not performed by the physician). • The NP carried a beeper and during Monday through Friday daytime hours was the first to be called by the nursing home staff regarding acute problems. • Physicians were consulted regarding care decisions with the need for consultation determined by the individual NP. • Physicians were informed by the individual NPs about patient changes in condition on a case-by-case basis. The NP was able to consult with specialists at the institution and to schedule clinic appointments as needed for patients.
Burl et al. (44) 1998 USA	*Control:* Physician only care. *Intervention:* NPs worked with up to 12 physicians. Each NP follows approximately 110 resident in one to three facilities. • The NP performed admission of new patients and developed a comprehensive plan of care addressing medical, functional, and psychosocial issues. • The physician was required to see the resident within 10 days and to review the NP's plan of care. • The NP and physician alternated regulatory visits so that one cycle is a team visit with both providers on site, and the next routine visit may be done either by the team or by the NP alone. • Annual physical examinations were done by the NP. • The NP carried a beeper and took the first call on all of the residents. • The NP made episodic visits when indicated or managed minor problems via telephone. • The NPs took first call weekdays from 5:00 p.m. until 9.00 p.m. • The NP was available Monday through Friday, 8 a.m. to 5 p.m. for the facilities, and was on site at each facility several times a week. • The physician made episodic visits at the request of the NP but, as a rule, was on site only for routine visits and new admissions. The NP participated in both formal and informal education of the nursing staff.
Johnson (35) 1997 USA	*Control:* Physician only care. *Intervention*: Physician/NP team care.

Additional Table S1 *continued*

Klaasen et al. (31) 2009 Canada	*Control:* • Three physicians, each with a caseload of 38 residents. • Each physician was on site once a week for one to two hours. • The assigned attending physician managed acute care issues and consulted after hours and on weekends via phone calls. Introduction NP: • The NP entered into a collaborative practice agreement with the medical director to provide primary care to 38 residents. • The medical director co-signed all orders. Intervention: • The NP and the medical director took over the care of all residents, because the other two physicians resigned. Later on: • The NP became the primary care provider - with the medical director acting as a consultant. • The NP worked on site Monday to Friday • The NP did all histories and physical examinations, diagnosed and managed acute illness and chronic diseases, ordered medications and diagnostic investigations and performed minor surgical and invasive procedures that fell within the scope of NP practice. • The NP attended the annual care conference of residents and the quarterly reviews of the residents' medications. • The NP consulted with the medical director for second opinions and for his recommendations on the management of complex medical issues. • The NP contacted the medical director when she needed to prescribe or change the dose of medications that were outside the scope of her practice. • The medical director continued to provide medical services after hours and on weekends.
Ono et al. (43) 2015 Japan	*Control:* Physician only care (one full-time physician). *Intervention:* Physician (one full-time physician) and NP care: • The NP served the entire facility. • The NP conducted medical interview and/or physical assessment when a resident presented problems. • After reviewing results of the primary medical examination the NP consulted with the facility's full-time physician as well as the resident. • Then, the NP performed permitted specific medical practice according to the designated protocols. • The NP also met or consulted with residents' family members to explain about their health status, needs and treatments.

PRIMARY HEALTHCARE	
Agvall et al. (32, 33) 2013, 2014 Sweden	*Control:* A visit to the GP, where the medication administration plan was evaluated, and adjusted if necessary. This was according to local guidelines, and follow-up was once a year. *Intervention:* An initial consultation with the GP and, after that, a visit to a HF nurse in which: • Patients received oral and written information about HF from the HF nurse and from a computer-based information program. • Patients received a follow-up examination performed by the HF nurse with support of a GP according to *the European Society of Cardiology guidelines for the diagnoses and treatment of acute and chronic heart failure 2012.* Changes in medication were made by the treating GP. An additional visit was made to the HF nurse after 2 months to ensure that the participant's medical treatment was optimized. In addition, the HF nurse contacted participants via telephone after 1 month and after 6 months. Additional contacts were planned only if there was a clinical need. All participants in the intervention group had the possibility of directly contacting the HF nurse at the primary healthcare center by telephone during office hours.
Cardozo et al. (40, 41) 1998 USA	*Control:* A MR/faculty physician clinic. • MRs typically spend half a day per week in the ambulatory care clinic and see their patients by appointment. Patients with acute problems can access the clinic as necessary and are seen by resident designated to take care of walk-in patients for that day. • The MR is supervised by faculty physicians who discuss assessment and plans of treatment for every patient seen by the resident. • MRs spend 40-50 minutes on a new patient visit and 30 minutes for a return visit. *Intervention:* an NP/faculty physician clinic. • The NPs are available to their patients on a daily basis for any acute problem, Routine care is rendered by appointment and provided primarily by the NP with physician supervision. • Every new patient seen by the NP has a follow-up visit with the physician. During the comprehensive initial visit by the NP a physician is available in the office suite for consultation. • Patients are also seen by the physician if they are medically unstable, following an emergency department visit, after hospital discharge, and on a routine basis at least once a year. NPs spend about 20% more time for the initial visit than MRs.

Additional Table S1 *continued*

Everett et al. (37, 38, 59) 2013, 2014 USA	*No information given on the provided care.* *Using Medicare data patients were first assigned to the primary care clinic that provided the majority of their face-to-face visits in 2008. Patients were then assigned to the provider (physician, physician assistant or nurse practitioner) that provided the majority of visits within that clinic. In the event of a tie at either step, patients were assigned to the clinic/provider with the most recent visit. Patient panels were constructed by grouping patients assigned to the same usual provider of care within a clinic. Number of panels n=261:* *Control:* Not one visit by NP/PA in all patients of the panel: usual provider physician. Intervention Vast majority of the visits by NP/PA in patients of the panel: usual provider NP/PA. *Remaining group:* A panel of at least one visit of one patient by NP/PA: supplementary.
Ganz et al. (34) 2010 USA	*Control:* Physician only care for falls, UI, HF, dementia, and depression. • During the intervention period, the night before a physician's scheduled clinic, practice staff clipped an additional sheet to each patient's chart. • Control physicians were asked to note which (if any) of the 5 conditions would have prompted referral of the patient for NP co-management. *Intervention:* Co-management by NP for falls, UI, HF, dementia, and depression. • During the intervention period, the night before a physician's scheduled clinic, practice staff clipped an additional sheet to each patient's chart. • The sheet asked for which condition(s), if any, the physician would like the patient to see the NP, and the priority level for each referred condition. • The clinic scheduler received completed forms and arranged an appointment with the NP. • The NP could order tests and treatments without approval from the patient's geriatrician, but could obtain guidance if needed. • Patient follow-up visits were scheduled by the NP as needed (including phone contact). After each visit, the NP e-mailed or faxed the geriatrician a written assessment and plan, but handled more urgent issues via phone or pager.

Reuben et al. (42) 2013 USA	*Control:* Physician only care for falls, UI, dementia, and depression. The physicians had materials available so that they could implement the ACOVE-2 intervention (for falls, UI, dementia, and depression) without referring to the NP. *Intervention:* Co-management by NP for falls, UI, dementia, and depression. Physicians were encouraged, but decided on a case-by-case basis, to refer to the NP for co-management. NP co-management of the conditions (falls, urinary incontinence, dementia, and depression) followed the ACOVE-2 model, including use of structured visit notes that have important care processes embedded in them, patient education an empowerment, decision support, and linkage to community recourses.

ACOVE = Assessing Care of Vulnerable Elders, CG = control group, GP = general practitioner, HF = heart failure, IG = intervention group, MD = doctor of medicine, MR = medicine resident, NP = nurse practitioner, PA = physician assistant, QI = quality indicator, UI = urinary incontinence

Additional Table S2 Outcomes

Outcome	Study	Measurement	Control group	Intervention group	Variance around the difference	P value
LONG-TERM CARE FACILITIES						
Patient outcomes	Abdallah et al. (36)	Health status and functional ability:				
		Logistic models				
		Living will:	OR 1.618	Reference	NR	0.18
		Do not resuscitate:	OR 0.807	group	NR	0.51
		Do not hospitalize:	OR 1.560		NR	0.41
		Short-term memory:	OR 2.038		NR	0.24
		Long-term memory:	OR 0.962		NR	0.91
		Vision:	OR 1.690		NR	0.11
		Hearing:	OR 0.610		NR	0.13
		Linear models				
		Staff reported health status:	ß: -0.016		NR	0.88
		Health compared to 1 year ago:	ß: -0.012		NR	0.89
		Oral function:	ß: 0.188		NR	0.2
		Communication:	ß: 0.041		NR	0.69
		Socialization:	ß: 0.231		NR	0.22
		Mobility:	ß: -0.057		NR	0.61
		Behavioral:	ß: 0.097		NR	0.41

PRIMARY HEALTHCARE						
Patient outcomes	Agvall et al. (32, 33)	Changes of quality of life measurements:				
		Physical function:	-2	2	NR	0.27
		Role physical:	2	7	NR	0.51
		Body pain:	0	-2	NR	0.41
		General health:	-1	-1	NR	0.7
		Vitality:	-2	0	NR	0.71
		Social function:	-5	3	NR	0.11
		Role emotional:	-10	4	NR	0.06
		Mental health:	-2	3	NR	0.33
Process of care outcomes	Agvall et al. (32, 33)	Composite endpoint calculation included:				
		Echocardiography (points):	10	11	NR	0.85
		NT-proBNP (points):	0	50	NR	0.003
		Physical component scale of Short Form 36 (points):	17	6	NR	0.50
		Mental component scale of Short From 36 (points):	-29	10	NR	0.04
		Hospital admission (points):	-32	-24	NR	0.23
		Survival (points):	-15	-12	NR	0.76
	Cardozo et al. (40, 41)	Secondary prevention performance rate				
		Breast examination:	44%	85%	NR	NR
		Pelvic examination:	44%	98%	NR	NR
		Prostate examination:	16%	98%	NR	NR
		Stool guaiac test:	56%	96%	NR	NR
		Mammography:	58%	96%	NR	NR
		Prostate-specific antigen determination:	4%	34%	NR	NR
	Ganz et al. (34)	Dementia Quality of care:	30%	51%	NR	<0.001
		Depression Quality of care:	28%	51%	NR	0.07
		Falls Quality of care:	17%	44%	NR	0.002
		Heart failure Quality of care:	71%	82%	NR	0.06
		Incontinence Quality of care:	26%	58%	NR	0.01
	Reuben et al. (42)	Falls Quality of care:	32%	71%	NR	NS
		Incontinence Quality of care:	20%	66%	NR	NS
		Dementia quality of care:	38%	59%	NR	NS
		Depression Quality of care:	60%	63%	NR	NS

NR = not reported, NS = not significant, Shaded area = evidence of RCT

Additional Table S3 Implementation

Study	Implementation
LONG-TERM CARE FACILITIES	
Ackermann and Kemle (30)	Societal level: funding → Barrier • The fee-for-services model provided financial disincentives for acute care in nursing homes.
Aigner et al. (39)	Organizational level → Barrier • NPs rotated quarterly to one of three groupings of nursing homes.
Burl et al. (44)	Societal level; funding→Facilitator • The fee-for-service revenues were maintained to offset the costs associated with the NP program (salaries, administrative costs). • The long term care facility was reimbursed a skilled nursing per diem rate if the facility was agreeable to providing skilled nursing care in lieu of hospitalization. Societal level: funding → Barrier • Residents with acute care needs had to undergo a 3-day hospital stay and only after that their acute medical care in the long-term care facility was reimbursed.
Johnson (35)	Individual level: characteristics of the mid-level provider → Facilitator • The caring aspects of NPs. NPs may be more familiar with the type of comfort care that is needed in nursing homes. Furthermore, they might indicate patients who would not benefit from hospitalization and allow patients to die in a familiar setting. Societal level: funding → Barrier • Care in the hospital was more lucrative than nursing home care.
Klaasen et al. (31)	Organizational level → Facilitator • The support shown by facility and regional leadership in challenging the status quo. • The fact that practice changes were based on the best available evidence. • The fact that the NP was on-site five days a week to provide care and education for patients and staff. Individual level: characteristics of the mid-level provider → Facilitator • The following positive characteristics of the NP were described: NP's pioneering spirit, ability to work independently, thirst for knowledge and willingness to shape her own practice. Individual level: characteristics of the physician → Facilitator • The medical director's leadership and mentoring supported the mid-level provider in her transition from novice to expert in the care of older adults. Societal level: recruitment of a mid-level provider related → Barrier • Difficulties with the recruitment of a suitable mid-level NP; the recruitment took more than two years. Societal level: curriculum of the mid-level provider→ Barrier • The NP experienced a steep learning curve as gerontological content was no part of the nursing curricula. Societal level: legislation → Barrier • Limiting legislation limited the scope of the NP; the NP was not able to sign death certificates and prescribe controlled substances. Individual level: characteristics of the physician → Barrier • Establishing trust with physicians was challenging.

PRIMARY HEALTHCARE	
Ganz et al. (34)	Societal level: funding → Facilitator • The NP co-management was supported by a special grant. Organizational level → Facilitators • A run-in period was organized before the intervention period. During this run-in period the NP saw patients together with her supervisor and could develop her own practice style, familiarize herself with clinic operations, and build trust among referring physicians. Individual level: characteristics of the physician → Barrier • Physicians' unwillingness to share the responsibility of patient care, because they felt total responsibility for patients.
Reuben et al. (42)	Societal level: funding → Barrier/Facilitator • Pros and cons of the reimbursement types fee-for-service and managed care: fee-for-service payment would reimburse for NP visits, but the volume of cases would not capture enough reimbursement to cover the salary of the NP. In addition, in managed care, the practice needs to value the quality benefit of co-management highly enough to justify payment from the capitation or global rate. Individual level: characteristics of the physician → Barrier • Physicians' unwillingness to share the responsibility of patient care and their lack of knowledge or skepticism about what other disciplines may have to offer. Individual level: patient factors → Barrier • Patients were reluctant to follow through on the mid-level referral maybe because of the inconvenience of additional visits or an additional copayment or possibly unwillingness to see an NP.

NP = nurse practitioner

CHAPTER 4

Skill mix change between general practitioners, nurse practitioners, physician assistants and nurses in primary healthcare for older people: a qualitative study

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Abstract

Background: More and more older adults desire to and are enabled to grow old in their own home, regardless of their physical and mental capabilities. This change, together with the growing number of older adults, increases the demand for general practitioners (GPs). However, care for older people lacks prestige among medical students and few medical students are interested in a career in care for older people. Innovative solutions are needed to reduce the demand for GPs, to guarantee quality of healthcare and to contain costs. A solution might be found in skill mix change by introducing nurse practitioners (NPs), physician assistants (PAs) or registered nurses (RNs). The aim of this study was to describe how skill mix change is organized in daily practice, what influences it and what the effects are of introducing NPs, PAs or RNs into primary healthcare for older people.

Methods: In total, 34 care providers working in primary healthcare in the Netherlands were interviewed: GPs (n=9), NPs (n=10), PAs (n=5) and RNs (n=10). Five focus groups and 14 individual interviews were conducted. Analysis consisted of open coding, creating categories and abstraction.

Results: In most cases, healthcare for older people was only a small part of the tasks of NPs, PAs and RNs; they did not solely focus on older people. The tasks they performed and their responsibilities in healthcare for older people differed between, as well as within, professions. Although the interviewees debated the usefulness of proactive structural screening on frailty in the older population, when implemented, it was also unclear who should perform the geriatric assessment. Interviewees considered NPs, PAs and RNs an added value, and it was stated that the role of the GP changed with the introduction of NPs, PAs or RNs.

Conclusions: The roles and responsibilities of NPs, PAs and RNs for the care of older people living at home are still not established. Nonetheless, these examples show the potential of these professionals. The establishment of a clear vision on primary healthcare for older people, including the organization of proactive healthcare, is necessary to optimise the impact of skill mix change.

BACKGROUND

'Aging in place' is a way to provide patient-centred healthcare and has been recently introduced in many developed countries. It means that older adults are enabled to grow old in their own home or at least in their community regardless of their physical and mental capabilities (1). For developed countries, this means a reform that shifts care from hospitals and long-term care facilities to the community (2). This reform, together with the growing number of older adults, increases the demand on primary healthcare to provide suitable care to the older adults in the community (1). More and more general practitioners (GPs) are needed and they face a high number of older patients for whom the traditional reactive care delivery system appears unsuitable because they need more pro-active support to live a relative healthy live despite the problems they experience due to aging (1, 3). Furthermore, care for older people lacks prestige among medical students (4). In the Netherlands, only 0,5% of medical students prefer to proceed a career in care for older people (5), while GP is the most favorite specialization amongst students. However, Zwijsen et al. showed that GPs struggle to provide care to complex older patients, for example due to insufficient time or insufficient knowledge (6). Innovative solutions are needed to reduce the workload of GPs, to guarantee the quality of primary healthcare for older people and to contain costs. A solution might be found in skill mix change by introducing nurse practitioners (NPs), physician assistants (PAs) or registered nurses (RNs) into this field.

For the care for older people living at home, NPs, PAs and RNs may work as physician substitutes by independently providing the same services with similar responsibilities as physicians or performing tasks where the physician remains responsible for the tasks performed (referred to as task delegation) (7, 8). Physician substitution in primary healthcare appeared to achieve at least as good patient outcomes and process of care outcomes as care provided by physicians (9).

NPs, PAs and RNs may also work as physician supplements by providing additional services that complement or extend those provided by the physician (7, 8). The most commonly performed supplemental tasks by NPs, PAs or RNs in the care for older people living at home are providing proactive healthcare by geriatric assessment, preventive home visiting and/or case management. However, the effects of proactive healthcare for older people vary strongly across studies (10-18). These mixed results might be related to the different goals and designs of proactive healthcare and also to the organization of this skill mix change.

As far as we know, studies describing the different forms and characteristics of skill mix change in primary healthcare specifically for older people are scarce and are not described

in much detail (7). No study described the care provider perspective of skill mix change. For successful changes in skill mix, it is also crucial to get insight in the perspective of the professionals involved. Care providers know the daily work very well and have experience with what works and what does not work in organizing primary healthcare for older people. Therefore, the aim of this study was to describe the care provider perspective on how skill mix change for older people is organized, what influences it and what the self-perceived effects are of the introduction of NPs, PAs and RNs into primary healthcare.

METHODS

A qualitative approach using focus group interviews and individual interviews to collect data was used. We chose to conduct focus groups as these group interviews provide more information than the sum of individual interviews because of the interaction process (19).

Setting and interviewees

This study was conducted in primary healthcare in the Netherlands, including both general practice care and community care. In the Netherlands, general practitioners (GPs) are the gatekeepers of healthcare. In 1999, practice nurses (in Dutch: 'praktijkondersteuners') were introduced in general practices. These practice nurses support the GP in taking care of patients with chronic diseases according to an evidence-based protocol. NPs and PAs were introduced in general practices in 2001. At the moment, there are more than 3,000 practice nurses (some without a nursing background, but most RN) and approximately 140 NPs and 60 PAs working in general practices (20). In addition, approximately 8800 baccalaureate-educated RNs, called district nurses, work in the community (21). An unknown, but limited, number of NPs also work in the community. Each care provider in the Netherlands has its own professional profile. Since 2012, NPs and PAs are allowed to perform certain tasks related to diagnosis and treatment, such as independently prescribing drugs (20). First on an experimental basis, but in 2018 this will be incorporated in the legislation (22). GPs (working/have been working with an NP or PA), NPs, PAs and RNs working in primary healthcare were recruited for this study. We applied convenience sampling, although it was our goal to purposefully select the participants. Possible participants were contacted by their professional association/network and asked to fill out a short self-developed questionnaire. GPs were also contacted through NPs or PAs who filled out the questionnaire. It was planned to use the questionnaires to apply maximum variation sampling (on age, sex, workplace, years of experience, type of skill mix change) within the homogenous group of each profession. However, we received too little questionnaires to apply maximum variation sampling. Subsequently, everyone who filled out a questionnaire was invited for a (focus group) interview.

Data collection

Five focus groups and 14 individual interviews were conducted in two rounds. Attendance at each focus group ranged from two to six care providers. First, mono disciplinary focus groups (n=4) were organized as it is known that interviewees feel more comfortable, respected and free to give their opinion without being judged if they perceive that they are alike in some ways (19). As we were not able to arrange a focus group with at least 4 to 6 GPs within the research period, we decided to conduct individual interviews with GPs. In the first round of interviews, the following topics were discussed: tasks of the different care providers, barriers and facilitators and improvements and effects related to skill mix change (Additional file). The topics were based on a previous literature study (9) and finalized through discussion among the researchers. Second, a multidisciplinary focus group (n=1) and additional individual interviews were organized in which the results of the first round of interviews were discussed. The multidisciplinary focus group was organized to gain more in-depth information from a multidisciplinary perspective. This gave us the opportunity to confront the different disciplines with differences in views on the topics discussed. Care providers who participated in an individual interview were those interested in participating in the focus group interview, but who could not participate due to busy schedules during the research period. The focus group discussions lasted approximately 120 minutes and were moderated and observed by two or three researchers (MLo, AP, AvV, BJ). MLo was the primary researcher. She attended all focus group interviews and attended a two-day course on how to conduct focus group interviews prior to the event. The observer paid special attention to the interaction and non-verbal communication and made field notes. She also asked additional questions if needed. The individual interviews were conducted face-to-face or by phone by MLo and lasted about 30 minutes. Data were collected from October 2014 to May 2015.

Data analysis

All interviews were audio taped and transcribed verbatim. The computer program ATLAS.ti was used to code the interviews by two independent researchers (MLo, AvV) using content analysis. Analysis consisted of open coding, creating categories and abstraction (23, 24). The researchers (MLo, AvV) met regularly to compare and discuss their codes. The emerging main and subcategories were discussed within the research team (MLo, AvV, MLa, AP). Data saturation was reached in our sample. At the end of each (monodisciplinary focus group) interview we asked participants whether all topics were discussed. The interviews continued until all relevant topics were covered. In the second round of (multidisciplinary focus group) interviews, the first results were confirmed and discussed in-depth until no new information was gathered. However, as it was a convenience sample it is unknown whether another group of participants might provide new information.

RESULTS

In total, 34 care providers were interviewed: GPs (n=9), NPs (n=10), PAs (n=5) and RNs (n=10) (see Table 1). Some RNs were specialised in geriatrics. The RNs had European Qualification Framework (EQF) level 4 or 6 (25). NPs and PAs had EQF 7 and GPs had EQF 8.

The following four main categories were identified: a) roles and tasks of NPs, PAs and RNs, b) responsibilities of NPs, PAs and RNs, c) factors influencing skill mix change and d) impact of skill mix change. After the main categories, accompanying subcategories will be discussed.

Table 1 Interviewees' characteristics

Type of interview	Participants	Age Median (IQR)	Sex Female (n)
First round			
Focus group	NP *gp* (n=5) NP *gp* and *c* (n=1)	51.5 (35.3-52)	6
Focus group	PA *gp* (n=3)	41 (40.5-44.5)	3
Focus group	Practice nurse (n=3) Practice/district nurse specialized in geriatrics (n=1)	57 (55-59)	4
Focus group	District nurse (n=2)	25 and 51	2
Individual	GPs (n=7)	58 (53.5-59)	2
Second round			
Focus group	NP *c* (n=1) Practice nurse (n=1) District nurse (n=1) District nurse specialized in geriatrics *c* (n=2)	46 (42-51)	5
Individual	GPs (n=2) NPs *gp* (n=3) PAs *gp* (n=2)	45 (36.5-46.3)	6

c = community, *gp* = general practice, GP = general practitioner, IQR = interquartile range, NP = nurse practitioner, PA = physician assistant

Roles and tasks of NPs, PAs and RNs

NPs and RNs worked at general practices and/or in the community. PAs worked in general practices (see Table 1).

NPs, PAs and RNs in general practices

The NPs and PAs performed general consultations for patients from all ages at the general practice, and some NPs and PAs made home visits as well when patients were unable to come to the general practice for a consultation. Most NPs/PAs did not treat all patients, but depending on their experience and practice agreements, they excluded some specific complaints (e.g, stomachache, cardiovascular problems and neurological problems). Most

NPs had a more outlined package of tasks than PAs. RNs performed protocol led tasks for the treatment of patients with chronic diseases, such as diabetes mellitus, chronic obstructive pulmonary disease and heart failure. With regard to older people, the RNs, NPs and some PAs delivered proactive healthcare. This proactive healthcare varied from an unplanned preventive home visit, to structural screening on frailty by means of a (partial) geriatric assessment and the organization of multidisciplinary meetings. During multidisciplinary meetings, the care plan to support the older adult was discussed by the NP, PA or RN and other care providers, including the elderly care physician (i.e. nursing home physician specialist employed by a nursing home organization) (26). In some cases, the GP also joined the multidisciplinary meetings depending on the complexity of the case. Tasks of NPs and PAs in healthcare for older people were also medically orientated, they: performed medically screening, diagnosed and prescribed medication, while the RNs focused on nursing care. For examples of tasks see Table 2.

Table 2 Tasks in general practices

Provider	Population	Type of care	Examples of tasks[1]
NP, PA	All ages	Medical care[2]	Diagnosis • medical anamnesis (including psychosocial and functional status) • physical examination: examination of hearts, lungs, abdomen, examination of musculoskeletal system, neurological examination, dermatoscopy, ordering blood or feces tests Treatment • prescription of medication • small surgical procedures • psychosocial support • referral to other discipline • multidisciplinary treatment and/or support
	Older people	Proactive healthcare (combining medical and nursing care)	Varied from an unplanned preventive home visit to structural screening on frailty
RN	All ages	Providing nursing care to patients with chronic conditions such as: • diabetes mellitus • chronic obstructive • pulmonary disease • heart failure	• nursing anamnesis • nursing procedures e.g.: wound care, removing stitches (in order of GP) • psychosocial support • health education • health monitoring • care coordination
	Older people	Proactive healthcare (nursing care)	Varied from an unplanned preventive home visit to structural screening on frailty

GP = general practitioner, NP = nurse practitioner, PA = physician assistant, RN = registered nurse

[1] Tasks were described in the sampling questionnaire and the (focus group) interviews

[2] Delineation varied per profession (NPs had a more outlined package of tasks than PAs) and per individual; some NPs/PAs excluded some specific complaints (e.g., stomachache, cardiovascular problems and neurological problems)

"I have set up the module healthcare for older people together with the GP who did the overarching things, but we (the NPs) shaped the module, which means screening, making agreements on how to screen, who will screen and why … the GPs do not have time for that. I arrange all multidisciplinary meetings and I do all home visits". (NP 1.2)

NPs and RNs in the community

Two NPs and several RNs (the district nurses) worked outside the general practice. One NP who had a dual employment contract both at the general practice and at a home care organization performed structural screening on frailty. Another NP employed by an organization that delivered transmural care developed activities with a specific focus on older people: proactive healthcare, liaison service for GPs and district nurses and developing care paths. The NPs stated that they only performed nursing tasks. They were searching for their role in the care for older people living at home to optimise their scope of practice to education level and legislation. The lack of a vision in organizations on the NPs' role was perceived as a barrier. The district nurses mainly provided nursing care and proactive healthcare (i.e., networking with other care providers or structural screening of older people similar to the screening performed by providers in general practice and the NPs in the community). The RNs stated that they increasingly worked in collaboration with GPs to provide integrated care for older people. For examples of tasks see Table 3.

Table 3 Tasks in the community

Provider	Population	Type of care	Examples of tasks[1]
NP	Older people	Proactive healthcare (nursing care)	• screening of older people • liaison service for GPs and district nurses • developing care paths
RN	All ages	Nursing care	• support activities of daily living • nursing procedures e.g.: blood pressure control, give an injection (in order of GP) • psychosocial support • health education • health monitoring • care coordination
	Older people	Proactive healthcare (nursing care)	• networking with other care providers structural • screening on frailty

GP = general practitioner, NP = nurse practitioner , RN = registered nurse

[1] Tasks were described in the sampling questionnaire and in the (focus group) interviews

Responsibilities of NPs, PAs and RNs

The RNs worked in close collaboration with the GPs and often they performed delegated tasks, while NPs/PAs worked more independently. Many interviewees reported that the GP had the final responsibility as the patients were listed at the general practice owned by the GP, although several NPs/PAs stated that they had shared responsibility

with the GP. Several interviewees said that NPs, PAs and RNs should set boundaries for their responsibilities and were responsible for their own actions. Some stated that these boundaries should be recorded while other stated that it is not possible to do so, because healthcare for older people is too complex.

"… that (distribution of responsibilities) I find a hard one. Of course, there are many things that she (NP) does independently, but in principle she always works under our responsibility, but within her own expertise". (GP 7.2)

Factors influencing skill mix change

This category exists of four subcategories: a) coordination, b) collaboration, c) opportunities for NPs, PAs and RNs to provide care to older people alongside GPs and d) acceptability.

Coordination

Coordination was deemed to be important in the collaboration in primary healthcare for older people as many different care providers are involved. However, some interviewees reported that different care providers saw each other as competitors. It was perceived to be important not to divide patient care, and most interviewees reported that it would be ideal if the older adult had one central care provider. However, they did not mention which professional this should be. All care providers involved should communicate regularly and preferably use the same (electronic) patient records.

"Sometimes when I have a conversation with a patient, I notice that this patient already had screening of which I'm not informed … So there is a lack of communication from the general practice". (nurse with specialty in gerontology and geriatrics from a home care organization 6.2)

"That (coordination) helps a lot. It helps every older adult if you are able to contact experts quickly. I do not need to know everything myself". (practice nurse 6.5)

Collaboration

Personal characteristics that influenced the collaboration between NPs, PAs or RNs and GPs were as follows: diversity in expertise, type of education, level of experience, personality and affinity with older people. Among GPs specifically, there was a diversity in their willingness to share responsibility for medical patient care with the NP, PA or RN.

"Do you as a GP want to share your responsibilities and work with someone else, or do you want to do it on your own? Yes, there are as many opinions as there are GPs". (GP 5.3)

Some NPs, PAs and RNs collaborated with one GP while others collaborated with several. Some NPs, PAs and RNs had regular meetings with a GP while others had ad hoc meetings only when a problem needed to be discussed. Many interviewees reported that it was important that the NP, PA and RN could always contact a GP for help when questions regarding the care for the older patient arose. In most cases, the GP was easily accessible.

It was stated that good communication and trust were key factors for a successful collaboration between care providers. The interviewees noticed that the collaboration grows over time, while the NP, PA or RN grows in her function and the GP learns to relinquish patient care.

"I think the trust you receive from the GP is a facilitator, the space to act or not to act". (PA 2.1)

Opportunities for NPs, PAs and RNs to provide care to older people alongside GPs
The interviewees agreed that the complexity of the care for older people living at home provides opportunities for NPs, PAs and RNs to provide care alongside GPs. There was, however, discussion about which professional was most suitable to offer care to older people. The main perceived difference between NPs and PAs was that the NP focuses on nursing and medical procedures and tasks, while the PA focuses mainly on medical procedures and tasks. Some interviewees doubted whether PAs without a nursing background were competent to provide healthcare to older people. In addition, some interviewees wondered whether healthcare for older people was too broad for the scope of practice of NPs. Interviewees saw a role for RNs in primary healthcare for older people as long as it was not complex and worked under supervision of a GP or an NP/PA.

"During consultations, it makes no difference whether an NP or PA does it. In healthcare for older people, it can be an added value if you have a nursing background and then, then you still have your nursing part, but if you only do consultations it makes no difference". (NP 1.1)

Although the interviewees debated the usefulness of proactive structural screening on frailty, when implemented, it was also unclear who should perform the geriatric assessment. Many interviewees (including the PAs) wondered whether this should be a task of PAs, as they mainly focus on cure, and proactive screening was perceived as care. NPs were reported to be competent to screen older adults with complex care needs. RNs could perform screening of the cases that were expected to be less complex; however, it was not clear whether this should be done by a practice nurse or by a district nurse.

Acceptability
Many interviewees reported that patients and their family do not know what to expect from an NP, PA and RN.

"Most older patients find it difficult. I always try to explain: it is a new function and I do tasks in the medical domain. I try to explain that as good as possible. In my case I have worked in the practice for a long time and people know me and most accept it. If it needs more explanation then I give that, of course, but most reactions are positive". (PA 9.2)

Several NPs, PAs and RNs reported that they experienced problems if they wanted to liaison with a medical specialist at the hospital or refer a patient to the hospital because the medical specialists stated that they only wanted contact with GPs.

According to interviewees, pre-conditions for the implementation of NPs, PAs and RNs were the support of the professional association of GPs and structural financing of primary healthcare for older adults by insurance companies. However, it was stated that this support was not yet optimal.

"At the moment, the barriers are the resistance by my GP colleagues. It is often hard to explain to people that within this project (proactive healthcare for older people), in our regional group of general practices we want to employ our NPs. While the regional group of general practices made agreements with the insurance company in which the NP does not fit". (GP 5.7)

Impact of skill mix change

The experienced impact of skill mix change is described under a) added value and b) changing role of the GP, subcategories.

Added value

Interviewees considered NPs', PAs' and RNs' contribution to quality of healthcare, provision of patient-centred care and strengthening of the care team in residential homes and homecare organizations to be an added value.

It was perceived that NPs, PAs and RNs contributed to quality of healthcare because, for example, the personal continuity of healthcare was improved as NPs, PAs and RNs were the central care provider for older people. Also, despite the doubts of the (cost) effectiveness of proactive healthcare for older people, it was stated that proactive healthcare provided by NPs, PAs and RNs enables care providers to intervene in a timely manner when something goes wrong.

NPs and RNs characterised themselves above GPs on the nursing domain in knowing their patients very well, having insight into social networks, being easily accessible for patients and family, having a holistic view, working proactively, giving attention to patients, and taking/having time for patients and family.

"Patients always say, "It is so funny, if you look at my feet, you always put my socks back on". (NP 1.4)

PAs also stated that they contributed more to patient-centred care because they were easily accessible for patients and family, had an overall view of patients, were well organized, took/had more time for patients and family than GPs. Almost all PAs interviewed had a nursing background and several PAs stated that their added value was due to their nursing background.

"The effect is, I think, the background as nurse and practice nurse. That is a background I like because my colleague (GP) says sometimes: (name) you do it a lot more precise than I and that is because you still have a broad view and you still also look, secretly, at the nursing aspects". (PA 2.2)

NPs, PAs and RNs were reported to strengthen the care team in residential homes and home care organization because they: coached, educated and trained them; reminded the care team of their own responsibilities and were easily accessible for the care team.

"As a district nurse, I form a link, together with my colleague, between the GP and the care team because the experience was that in the residential home they (GPs) were called too late or too early and, yes, they were very busy with the care for older people". (practice nurse 6.4)

Changing role of the GP

The introduction of NPs, PAs and RNs changed the role of GPs from a more clinical expert role for all patients to a more coordinating role with focus as clinical expert on the more complex patients. Positive perceived effects were that the workload for the GPs became lower, that their practices could be larger and that they had more time to focus on the more complex patients. Negative perceived effects were that the GPs had less patient contact and less freedom because they should be available for the NP, PA or RN and that the GPs only had consultations for complex patients increasing the caseload as NPs, PAs and RNs only had consultations for less complex patients.

DISCUSSION

Skill mix change by introducing NPs, PAs and RNs into primary healthcare for older people appeared to be only at the start of its development. In most cases, healthcare for older people was only a small part of the tasks of NPs, PAs and RNs (i.e. they do not solely focus on older people). The tasks they performed and their responsibilities in healthcare for older people differed between as well as within professions and were not always in line

with their education and legal authorisations; underuse of competences existed. Full potential of NPs, PAs and RNs in the care for older people living at home was, according to the interviewees, not yet reached, partly because a vision of the role of each professional in primary healthcare for older people was lacking. There was also discussion about how to organize proactive healthcare for older people where these professionals could have a leading role. In addition, skill mix change required team performance, collaboration, trust and acceptance of each other's expertise instead of competition. Skill mix change also affected the role of the GP and appeared to enhance quality of healthcare.

In accordance with our study, several studies have reported variation in the level of autonomy of NPs (and PAs, and RNs) (27, 28). In the Netherlands, NPs and PAs are allowed to perform certain tasks related to diagnosis and treatment independently, such as the prescribing of drugs (29). In contrast to this legislation, interviewees in the current study stated that the GP had final responsibility for patient care. There are three possible explanations for the fact that, in our study, the GP was reported to have final responsibility: 1) GPs, NPs and PAs do not know the legal boundaries of skill mix changes and the competences of NPs and PAs, 2) in the Netherlands, patients are listed at a general practice which is owned by a GP, which might enhance the sense of responsibility of GPs (26) and 3) research has shown that known that in collaborations care providers aim to maintain their power and that conflict or dissatisfaction may occur if their power is challenged (30, 31). Although power and autonomy are important in collaborations, care providers might respond more positively regarding collaborations if they are based on trust rather than power (31). In line with our study several studies have reported that the longer a GP works with an NP (or a PA, or a RN), the more (s)he trusts the NP and the more (s)he acknowledged the expertise of this professional (27, 30, 32). One of these studies showed that trust is positively related to the extent to which roles are accepted, demonstrated competences and good communication (30).

Collaboration in primary healthcare has been studied extensively, and two models of collaboration have been developed (33-35). The Four-Dimensional Model of Collaboration, which consists of internalisation, shared goals and vision and governance (33, 34), and the Gears Model of Factors Affecting Interprofessional Collaboration, consisting of individual, micro, meso and maso factors (35). Both models state that collaboration is influenced by factors on different levels: individual, team, information exchange, and governance (33-35). Next we will give some examples of how these models might be applied to primary healthcare for older people to improve collaboration in the light of skill mix change. For example, in the current study, there was discussion about the uniqueness of each care provider. A prerequisite for collaboration is mutual acquaintanceship (i.e., knowledge of each other's values and professions). Furthermore, care providers should not see each other as competitors. All care providers that are involved in the care for an older adult

should share the same goals and vision to provide the best available care to older people. This process should be facilitated through formalisation by means of digital patient records and by recording the responsibilities of the various care providers involved in the care for an older adult (33-35). In addition, on a higher level, discussions should be held on how to organize the care for older people living at home, such as who to employ from which setting, whether it is desirable to involve multiple care providers in the care for an older adult, etc. These discussions could be held at the state level, the professional association level, the insurance company level and the level of collaborating general practices (33-35).

This study has some limitations that should be considered while interpreting the results. First, the division of the interviewees in focus groups was not optimal. Some focus groups were very small, which diminished the interaction process between interviewees (19). In the multidisciplinary focus group, only one NP and different types of RNs participated. Therefore, no interaction with PAs and GPs could occur. To gain insight into their views on the results of the first round, PAs and GPs were interviewed individually. The difficulties in finding interviewees for the focus groups were due to the high workload related to the reforms in primary healthcare in the Netherlands. Second, self-reporting of activities might lead to social desirability bias (36). Interviewees might have reported their tasks and responsibilities different from reality. To overcome this problem, an observational study on the role of NPs, PAs and RNs in primary healthcare for older people should be carried out. Third, the study focused on the perspective of the providers and therefore lacks the perspective of older people and their family. It is important to explore the experiences and opinions of older people with skill mix change and to determine both their needs and the acceptability of the concept. The results of our current study provide detailed input for interviews regarding skill mix change. Especially, the acceptability and (un)familiarity with NPs, PAs and RNs are important topics to discuss, because it may result in ideas how to improve skill mix change

CONCLUSION

Although NPs, PAs and RNs are involved in the care for older people living at home, a huge variation in tasks and responsibilities between and within professions exists. A clear vision on care for older people, including the organization of proactive healthcare and roles and responsibilities of team members, is necessary to increase the impact of skill mix change on quality of healthcare. The role of the GP as the traditional care provider needs to change to maintain quality. All team members should be informed about legislation to ensure that NPs, PAs and RNs perform to their full potential.

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Additional file Interview guides

Interview guide *first* round of (focus group) interviews

1. What are your tasks in primary healthcare for older people?
   a. How does your position/occupation relate to the position/occupation of other professionals?
   b. What is your role in relation to other professionals?
   c. Who performs which tasks?
   d. Would you describe your tasks as substitution, delegation or supplementation?

2. What is the effect of skill mix change?

3. What are barriers and facilitators to skill mix change?
   a. What are chances, challenges, threats, conditions, and boundaries for skill mix change?

4. How should skill mix change be organized in the future?

What is your role in the future?
   a. Is it possible that another professional performs your tasks?
   b. Is it possible that you take over tasks from another professional?
   c. What will your position/occupation look like in 5 or 10 years?
   d. Who should perform which tasks?

Interview guide *second* round of (focus group) interviews

Interviewees received beforehand a summary of the findings of the first round of (focus group) interviews.

1. Do you recognize the results of the first round of (focus group) interviews?

Are the results complete?

2. What is the optimal model of skill mix change (for the patient) in what circumstances?
   a. Why should skill mix change be organized in this way?
   b. Which professionals work together?
   c. What is the goal of skill mix change?

3. Why is the optimal model of skill mix change not yet a reality?

Topics to discuss:
- Tasks
- Responsibilities
- Effects of skill mix change
- Barriers and facilitators to skill mix change

CHAPTER 5

5

Skill mix change between physicians, nurse practitioners, physician assistants and nurses in nursing homes: a qualitative study

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Abstract

Nursing home physicians face heavy workloads, because of the aging population and rising number of older adults with one or more chronic diseases. Skill mix change, in which professionals perform tasks previously reserved for physicians independently or under supervision, may be an answer to this challenge. The aim of this study was to describe how skill mix change in nursing homes is organized from four monodisciplinary perspectives and the interdisciplinary perspective, what influences it, and what its effects are. This study focused especially on skill mix change through substitution of nurse practitioners, physician assistants, or registered nurses for nursing home physicians. Five focus group interviews were conducted in the Netherlands. Variation in tasks and responsibilities was found. Despite this variation stakeholders reported increased quality of healthcare, patient-centeredness, and support for care teams. A clear vision on skill mix change, acceptance of nurse practitioners, physician assistants, and registered nurses and reduction of legal insecurity are needed might maximize the added value of nurse practitioners, physician assistants, and registered nurses.

INTRODUCTION

The number of older adults with (chronic) diseases and multimorbidity increases rapidly, resulting in a rising pressure on nursing homes (1). Concurrently, few medical students are pursuing a career in healthcare for the aging population (2). Moreover, quality deficits, such as use of unnecessary restraints, in nursing homes are an issue of international concern (3). Changing the skill mix by introducing nurse practitioners (NPs), physician assistants (PAs), and baccalaureate educated registered nurses (RNs) in nursing homes might diminish physicians' workload and enhance quality of healthcare (4, 5). These professionals can perform tasks previously reserved for physicians.

In the Netherlands adults from all ages with complex care needs are entitled to a place in nursing homes. The mean age of nursing home residents was 85 years in 2015/2016 (6). Nursing homes mostly consist of three types of units: units for patients with physical disabilities, dementia special care units, and geriatric rehabilitation units. Multidisciplinary teams are employed by the nursing homes, including, nursing home physicians (called elderly care physician (ECP)), nurses, physiotherapists, dieticians, and psychologists (7). Elderly care medicine is a unique specialty with a 3-year training program that exists nowhere else in the world (7).

At present, 1,524 ECPs work in Dutch nursing homes, but the vacancy rate is more than 10% (8). This shortage is one of the reasons why NPs and PAs were introduced, resulting in about 300 NPs and 40 PAs currently employed in nursing homes. In addition, an unknown but relatively low number of RNs work in nursing homes to support ECPs. Actual care is provided by certified nurse assistants and vocationally trained registered nurses (9). NPs and PAs are educated at master's level and their title is protected by law; that is, it is reserved for those who have completed a Master Advanced Nursing Practice or a Master Physician Assistant and are registered in their specialty register.

Since 2012, NPs and PAs who are qualified and work in accordance with the legal framework are allowed to independently indicate and perform some of the so-called "reserved procedures", which were initially reserved for physicians, e.g. giving injections (10). RNs are only allowed to perform reserved procedures when showed to be qualified and after instructions from a physician, NP, or PA (i.e. delegation). While RNs mainly provide nursing care, NPs combine nursing care with medical care and PAs mainly provide medical care (11, 12).

Skill mix change by introducing NPs, PAs, or RNs is achieved through: (1) task delegation from physicians; moving a task to a lower grade provider (physician remains responsible); (2) physician substitution; expanding the breadth of a job by providing the same

services as the physician (new provider is responsible/autonomous); or (3) physician supplementation; increasing the depth of a job by providing additional services that complement or extend those provided by the physician (13, 14). In practice we may see a combination of the three different types of skill mix change in nursing homes (15-17).

The shortage of ECPs has generated interest in physician substitution by NPs, PAs, and RNs. It is expected that NPs and PAs substitute for ECPs more than RNs, given their level of education, qualifications, and authorizations (18, 19). Nevertheless, RNs may sometimes substitute for physicians as the work of physicians goes beyond reserved procedures, for example, patient assessment (13, 16).

A recent systematic review evaluated the effects of physician substitution by NPs, PAs or RNs in nursing homes and primary healthcare for the aging population. Physician substitution appeared to achieve patient outcomes, such as health status and functional ability, and process of care outcomes, which were at least as good as when care was provided by physicians (20). This review also showed several challenges in introducing NPs, PAs, and RNs, such as physicians' unwillingness to share responsibility for patient care (20). In practice, changes in skill mix are often introduced by government and managers. However, to achieve successful changes in skill mix, it is important to assess the perspectives of the involved professionals (21).

Study aim

The aim was to describe how skill mix change in nursing homes is organized from four monodisciplinary perspectives and the interdisciplinary perspective, what influences it, and what its effects are. This study focused especially on skill mix change through substitution of ECPs by NPs, PAs, or RNs.

METHODS

Design

This was a generic qualitative study using focus group interviews based on a topic list and content analysis (22, 23). Focus group interviews provide more information than the sum of individual interviews due to the interaction process (24). The COREQ (COnsolidated criteria for REporting Qualitative research) checklist was used for reporting the study (25).

Participants and setting

Four groups were purposefully selected to participate in a monodisciplianry focus group: ECPs (working/have been working with an NP or PA), NPs, PAs, and RNs working in Dutch nursing homes. In order to identify eligible participants, the professional association/

network of each profession contacted its members by email or digital platforms and asked them to fill out a short self-developed questionnaire on age, gender, workplace, years of experience, and type of skill mix change.

The questionnaire was meant to sample participants per group based on maximum variation (26). Due to limited response it was only possible to make a purposeful selection in the group of NPs. The ECP, PA, and RN who filled out a questionnaire were invited for a focus group interview (convenience sampling).

Data collection

For the focus group, the following topics related to skill mix change were discussed: tasks, barriers, facilitators, improvements, and perceived effects (Additional file). The topics were based on a previous literature review and discussion among the researchers (20). The monodisciplinary focus groups were followed by one interdisciplinary focus group to gain more in-depth information from an interdisciplinary perspective. This enabled us to discuss the differences of opinions within the various disciplines. The focus group discussions took place at meeting centers, lasted approximately 120 minutes, and were moderated and observed by two researchers. One of these researchers attended all focus group interviews and a 2-day course on how to conduct focus group interviews prior to the events. Each focus group started with an introduction round, followed by a discussion of the items on the topic list. The observer(s) paid special attention to interactions and nonverbal communication, made field notes, and asked additional questions if needed. The moderators and observers all had knowledge of the topic as they had conducted previous studies about skill mix change. This helped them to stimulate discussions during the focus groups, for example by asking challenging questions. They were aware of the necessity to keep an open mind while collecting data. They discussed this within the research team and after each focus group. Data were collected from October 2014 to May 2015.

Each participant received an information letter explaining the goal of the study, the interview procedure, and confidentiality of data. Participants of the monodisciplinary focus groups also received additional information about the research questions, definitions of the different forms of skill mix changes, and examples of skill mix change. The participants in the interdisciplinary focus group received a summary of the results of the monodisciplinary focus groups beforehand.

Data analysis

All interviews were audiotaped, transcribed verbatim, and independently coded in Atlas.ti by two researchers. An inductive content analysis was performed, consisting of open coding, creating categories, and abstraction (27-30). Two researchers discussed

and compared their codes until consensus was reached. The emerging categories were discussed within the research team.

Rigor

The trustworthiness of the study findings was based on the following criteria: credibility, dependability, confirmation, and transferability (31). Credibility was promoted by the fact that the interview topics were based on a systematic review. In addition, the researchers who conducted the interviews all had knowledge of skill mix change. The interdisciplinary focus group can be viewed as a member check, in which additional viewpoints were discussed. Confirmation was enhanced by extensive discussion of the results within the research team, which includes people with different backgrounds, i.e. nurses and ECPs. The results were extensively discussed within the research team. Clear descriptions of the participants and setting, data collection procedures, and the process of analysis are presented to promote dependability and facilitate readers' judgments about transferability.

Ethical considerations

The research ethics committee of the region Arnhem Nijmegen concluded that this study did not fall within the scope of the Medical Research Involving Human Subjects Act (WMO) (registration number 2014/298) and that the study could be carried out. Written informed consent was obtained from all interviewees at the start of each interview after they received written and verbal information. The confidentiality and privacy of the interviewees and their responses were assured.

RESULTS

Interviewees' characteristics

In total, 32 providers, who worked for 26 different nursing homes, were interviewed (Table 1). All RNs had additional training in geriatrics or as a practice nurse. The RNs had European Qualification Framework (EQF) 4 or 6. EQF is a European reference framework that aims to make qualifications more readable and understandable across different countries and systems (32). NPs and PAs had EQF 7 and ECPs had EQF 8.

Categories

Three main categories emerged from the analysis: variation in skill mix change, factors contributing to variation, and impact despite variation. These categories are interrelated; the different factors contributed to the variation of skill mix change, and despite the variation, skill mix change was perceived to have impact. The main categories and their subcategories are described below (see Table 2 for data excerpts, codes and category classification).

Table 1 Interviewees' characteristics (n = 32)

Focus group participants	Age Median (IQR)	Female
First round		
• NP (n = 8)	52 (49-53.5)	n = 7
• PA (n = 5)	52 (48-52)	n = 2
• ECP (n = 7)	53 (37.5-57)	n = 5
• Practice nurse (n = 3) Geriatric nurse (n = 1) Nurse in training for specialty in gerontology, geriatrics (n = 1)	50 (49-53)	n = 5
Second round		
• ECP (n = 2) NP (n = 2) PA (n = 2)[1] Practice nurse (n = 2)	50.5 (43.3-55.8)	n = 4

ECP = elderly care physician, IQR = interquartile range, NP = nurse practitioner, PA = physician assistant.
[1]one PA also participated in the first round

Variation in skill mix change

Skill mix change by introducing NPs, PAs, and RNs was organized in various ways. This category included the following subcategories: 'unit versus organizational level', 'levels of complexity of tasks', 'variation in collaboration with ECPs', and 'different ideas about responsibilities'.

Unit versus organizational level

Most NPs, PAs, and RNs took care of older adults at one or more units in the nursing home, e.g. units for patients with physical disabilities, dementia special care units, or geriatric rehabilitation units. Several providers also had a special area of expertise at the organizational level, for example, medication safety, physical restraints, wound care, or lung diseases and oxygen use. Most NPs, PAs, and RNs were positioned in the medical team, some RNs in the nursing team.

Levels of complexity of tasks

The tasks of NPs and PAs were largely comparable, although PAs performed more complex tasks (related to multimorbidity and beyond protocols). Examples of tasks NPs/PAs took over from ECPs were: intake of new patients, medical rounds, multidisciplinary and family meetings, and prescribing medication. There was little variety in tasks performed by PAs, as they performed quite complex medical tasks. Tasks of NPs varied from only performing tasks according to protocol (delineated) to performing more complex tasks.

Table 2 Data excerpts and category classification

Data excerpts	Code	Subcategory	Main Category
'I work on a dementia special care unit, with 12 beds, and on unit for patients with chronic physical disabilities, also with 12 beds. I'm the medical contact person.' (PA 2.4) *'Two years ago the board of directors asked all the practice nurses to follow a specialization course at bachelor level, so we all did that. My specialization is care for patients with diabetes mellitus care and nutrition.'* (practice nurse 4.2)	*Working at a unit* *Having a special area of expertise at the organizational level*	Unit versus organizational level	Variation in skill mix change
"On the medical domain, we re-invented the wheel, shaped by the elderly care physician who supported me. We have made a delineation of healthcare problems that I am allowed to treat." (NP 1.4)	*PA: complex medical tasks* *NP: medical tasks varying from 'according to protocols' to 'complex'* *RN: nursing task and supporting ECP in medical tasks*	Levels of complexity of tasks	
"We call or meet ad hoc if they (NP or PA) want to show or ask me something. When you have a personal connection, interaction is easier. I have been trainer of four people and sometimes this goes well and sometimes it does not go well." (ECP 3.7)	*One versus more ECPs* *Structural versus ad hoc meetings* *Working alone versus working in partnership* *Peer consultation versus supervision* *Collaborative agreement* *Trust*	Variation in collaboration with ECPs	
"…actually in our medical team the idea prevails that the elderly care physician I work in partnership with and who is my supervisor, has the final responsibility for everything I do, while in practice, because I work very independent, I'm responsible for everything I do. Actually I only give it (responsibility) to him if I ask him something or ask to observe something along with me." (NP 1.2)	*Legal consequences* *Final responsibility*	Different ideas about responsibilities	

"…the vision and the spot on the horizon, that was a barrier for me, especially in the beginning, because there was no spot on the horizon…" (NP 1.4)	*Employment by coincidence* *Vision not a priority* Conservative standpoint *the Dutch association of ECPs*	Lack of a vision	Factors contributing to variation
"…most practice nurses need three to four years to eliminate resistance, because actually every nursing assistant or nurse wants to talk to a physician and not to his assistant…" (practice nurse 4.3) *"Sometimes I fall on my face terribly. If I, for example, want to consult a cardiologist in our hospital, then I do not even get him on the phone, as the assistants, the people of the outpatient clinic, have the instruction to only forward the call if it is a physician."* (NP 1.6) *"We are educated to think and act like a physician. We are all physicians, it is in our name. And NPs are often employed on a certain specialism."* (PA 2.5) *"But I think a PA fits better in the hospital, in medical unit care."* (NP 1.3)	*Unfamiliarity* *Struggles in daily practice* *Issues related to the domain of the other professionals*	Lack of acceptance	
"… and I have to say, like you said, it (physician substitution) differs from physician to physician, how open they are to it (physician substitution), I see that too at our place…" (ECP 5.1)	*Personal characteristics and ideas of ECPs* *Personal characteristics and ideas of NPs* *Personal characteristics and ideas of PAs*	Personal factors	

Table 2 *continued*

"And you have more continuity. Indeed medical residents, a year then they are gone." (ECP 3.6)	*Contribution to quality of healthcare*	Added value	Impact despite variation
"We (NPs) have a broader view. I always give the example: a baker who does not want to sleep anymore at 6 o'clock in the morning, because he is used to wake up at 4 o'clock for 40 years … Then you can give him pills (sleep medication), but I think you have to go where the patient goes. And you have to involve the night shift, give that man something to do. (…) Then you see that our view differs from the view of a physician. A physician would prescribe medication more quickly, so to make him sleep." (NP 1.1)	*Provision of patient-centered care* *Support of the care team*		
"Yes I perceive that that (shaped at the unit at the bedside) is more accessible and that is not my opinion, that is what the care team says. Yes, because the step to the physician … , we have to take in mind that they are the care team, they see the physician as a status symbol." (PA 5.5)			
"I expect from the future that it (skill mix change) will and has to be introduced more, because if I look at my 35-year career, what my tasks were as physician, I intervened in everything because there was no one and I arranged everything, I even knew it when glasses were lost." (ECP 3.1)	*Negative side of monitoring role* *Positive side of monitoring role*	Changing role of the ECP	

ECP = elderly care physician, NP = nurse practitioner, PA = physician assistant, RN = registered nurse

The RNs reported to prepare the work for ECPs and support them in medical care. They also provided nursing care. They performed medical tasks such as preparation before the medical round, assessment of patients in acute situations, monitoring of diabetes mellitus, and prescribing medication (medication was checked by an ECP in advance or afterwards).

Variation in collaboration with ECPs

Collaboration with the ECPs varied from collaboration with only one ECP to a group of ECPs. Some NPs, PAs, and RNs had structural meetings with an ECP, others only had ad hoc meetings.

Most NPs/PAs described the patients they took care of as those they were responsible for; others reported that they worked on the unit in partnership with the ECP. If necessary,

NPs/PAs asked an ECP for help, which some called supervision, while others called it peer consultation. The RNs mainly worked under the supervision of an ECP.

A collaborative agreement between NP, PA, or RN and ECP on prescription of medication, collaboration methods, and responsibilities was deemed to be important to create clarity. Not all nursing homes had such agreements.

Some interviewees reported that trust and personal connection between ECPs and NPs, PAs, or RNs were more important than agreements. All interviewees reported that an NP, PA, or RN should always be able to contact an ECP for consultation, by phone or face-to-face.

Different ideas about responsibilities

All providers were concerned about the legal consequences of substituting responsibilities and added that more information about the legal aspects of doing so was needed. Different opinions were expressed with regard to responsibility of the NP, PA, or RN. Some NPs/PAs stated that they themselves had final responsibility and were able to perform as head practitioner; others stated that only the ECP could have final responsibility. Nevertheless, many NPs/PAs said they were responsible for their own actions and boundaries. Some ECPs stated they always held final responsibility, others spoke of a shared responsibility, and some were searching for the right division of responsibilities. ECPs thought that PAs could handle a greater responsibility than NPs. Finally, most RNs stated that the ECP always had final responsibility.

Factors contributing to variation

Variation in the organization of skill mix change was caused by different factors: 'lack of a vision', 'lack of acceptance', and 'personal factors'.

Lack of a vision

Reasons to employ an NP, PA, or RN were to substitute for or support ECPs, to improve quality of healthcare, and to lower expenses. In many cases the decision to employ an NP, PA, or RN was more or less the result of coincidence rooted in external factors such as grants for training of NPs and PAs and a shortage of ECPs. A clear vision on roles, tasks, and responsibilities of NPs, PAs, and RNs was lacking or at least unknown to the interviewees. A vision was considered a prerequisite that would support skill mix change in nursing homes, as it would provide more clarity about its goals and the roles of each provider. Interviewees stated that managers and ECPs did not prioritize the formulation of a vision, due to high pressures on nursing homes. ECPs mentioned that the Dutch association of ECPs had issued guidance on how to organize skill mix change, but the standpoint of the

association was conservative, ambiguous, and more reserved than that of the professional association of NPs.

Lack of acceptance

Acceptance of the NP, PA, or RN was considered to start with familiarity with their function, tasks, and responsibilities in the nursing home and on societal level. Many interviewees reported that managers, ECPs, other providers, and patients and their family were ignorant of the function of NPs, PAs, and RNs. Diversity in the types and employment of providers did not contribute to acceptance.

Some PAs were appointed as medical resident or NP, which they perceived as an acceptance problem and a reflection of the absence of a vision. NPs, PAs, and RNs often experienced problems if they wanted to contact a hospital physician because some hospital physicians only wanted contact with physicians from the nursing home.

Issues related to the domain of the other provider were present as well. NPs stated that PAs were more medically oriented and they wondered whether PAs without a nursing background were able to work in nursing homes. PAs stated that NPs could only work on one medical specialty and they thought nursing home care was too broad for NPs. In addition, RNs saw a broader role for themselves than did the other interviewees.

Personal factors

Providers' personal characteristics and ideas contributed to diversity in the organization of skill mix change. Among ECPs there was diversity in willingness to share responsibility, level of experience, and personality. Among NPs there was diversity in level of preceding experience, level of autonomy, and personality. An extra variety among PAs appeared to be their professional educational background (e.g., physiotherapist, nurse). These differences made it necessary to seek harmonization within each individual collaboration between ECP and NP/PA. This collaboration had to grow over time. Diversity among RNs seemed not to be an issue.

Impact despite variation

The introduction of NPs, PAs and RNs was perceived to have an impact on 'added value' and 'the role of the ECP', although skill mix change was organized differently.

Added value

NPs', PAs', and RNs' contributions to quality of healthcare, provision of patient-centered care, and support of the care team were perceived to be an added value.

NPs, PAs, and RNs were reported to contribute to quality of healthcare by improving continuity of care, registration of the ECP in the medical record became more structured, and quality improvement projects took place.

NPs and RNs perceived that they distinguished themselves from ECPs on the nursing domain, which contributed to improved patient-centered care, because they knew their patients very well, involved family, leveled with patients and family during conversations, were accessible to patients and family, had an overall view of the patient, worked by means of a process, and took/had time for patients and family. PAs also reported that they improved patient-centered care because of their interest in patients, accessibility and time for patients and family.

Participants perceived that NPs, PAs, and RNs supported the care team because they were accessible, coached, educated, and trained the team, reminded them of their own responsibilities, positioned themselves next to and not above them, took them seriously, took/had time for them, understood the daily practice, and had an exemplary role.

Changing role of the ECP

The role of ECPs changed by the introduction of NPs, PAs, and RNs from a more practical role to a role further away from patients to a coordinator. Some ECPs did not like this role; they stated that they missed patient contact and risked losing their skills. Some ECPs said that they had more time for other tasks such as complex care, workgroups, and tasks in primary healthcare. Several ECPs stated the negative effect of having more night and weekend shifts (because most NPs, PAs, and RNs did not do those shifts).

DISCUSSION

The aim was to describe how skill mix change in nursing homes is organized from four monodisciplinary perspectives and the interdisciplinary perspective, what influences it, and what its effects are. This study focused especially on skill mix change through substitution of ECPs by NPs, PAs, or RNs. Great variation in skill mix change was found. Despite this variation stakeholders reported increased quality of healthcare and a new role for ECPs. A clear vision on skill mix change in nursing homes was missing. Skill mix change was further influenced by lack of acceptance of NPs, PAs and RNs by colleagues and patients and by providers' personal ideas.

The result confirmed the findings of other studies that skill mix change in nursing homes shows great variety and is still evolving (5, 20, 33). All NPs, PAs, and RNs worked at the unit level. PAs took over a broad range of (complex) tasks from ECPs. Among the NPs there was

a range from only performing tasks according to protocols to performing more complex tasks. The RNs reported that they prepared work for ECPs and supported them in medical care. Some NPs, PAs, and RNs also worked at organizational level with a special area of expertise. The interviewees described great variation in how NPs, PAs, or RNs and ECPs collaborated and in (ideas on) division of responsibilities. Discussions among interviewees were hindered by their confusion about the meaning of substitution, delegation and responsibility, and the legal consequences of substituting responsibilities. Therefore, it was difficult to specifically describe the ECP substitution, as this study aimed to do.

Despite the variation in skill mix change, NPs, PAs, and RNs were considered an added value. A recent systematic review already showed that physician substitution in healthcare for the aging population appeared to achieve at least as good patient and process outcomes as care provided by physicians (20). The current study revealed that NPs, PAs and RN add to good patient care by their contributions to quality of healthcare, provision of patient-centered care, and strengthening of the care team. In addition, the role of the ECP changed after introduction of an NP, PA, or RN into a more coordinating and supporting role.

In line with findings of other studies, this study showed that introducing NPs, PAs, or RNs into nursing homes is influenced by factors at the social, organizational, and professional levels (20, 34, 35). To overcome the problems related to role clarity and acceptance and to diminish the influence of personal factors it is important to enter into dialogue at these different levels (21). At professional societal level, the current study showed the need for a joint agreement on skill mix change between the national association of ECPs and the professional associations of NPs, PAs, and RNs (20, 35). At organizational level, the current study showed that a vision on skill mix change was lacking or at least unknown to the interviewees. Bryant-Lukosius and DiCenso developed a framework for organizations to help them develop a vision on roles tasks and responsibilities of advanced practice nurses in relation to patients' needs, called "the spot on the horizon" (21). Organizations should answer questions about which profession will be employed, in which manner, and with what purpose. These questions should be answered together with important stakeholders, such as providers themselves, to gain support for skill mix change.

Finally, the current study showed that the tasks and responsibilities of each NP, PA or RN should be discussed and recorded in dialogue with the collaborating ECP(s). Among the interviewees in this study there was ignorance and insecurity regarding transferring responsibilities. For example, they talked about final responsibility, while all providers regardless of level are responsible for their own actions. Literature suggests that a collaborative agreement is important to create clarity (4, 36, 37). However, the details about what such an agreement should include are a point of discussion. Some believe

it should focus on the process 36), while others state that it should focus on specific behaviors by specific providers (37).

Compared to other international studies, our study is unique in combining the perspective of all providers involved in skill mix change, by first conducting monodisciplinary focus group interviews and then bringing professionals together in an interdisciplinary focus group interview. This led to an in-depth providers' perspective on the way skill mix change in nursing homes is organized. Some limitations should be considered while interpreting the results of this study. First, self-reporting of activities might lead to social desirability bias and might influence the credibility of the results (38). Interviewees might have described their tasks and responsibilities in ways that did not reflect their true practice. In addition, it was our goal to gain insight into the perspective of the providers, but it would be interesting to combine the perspectives of providers, managers, and patients to enhance credibility. To gain insight into these perspectives and the role of NPs, PAs, and RNs in real practice, a case study using different data collection methods, including observations, could be carried out (39). Second, the organization of Dutch nursing homes differs from other countries, which might hamper transferability of the results. In the Netherlands ECPs are employed by the nursing home and able to support NPs, PAs, and RNs. It is unclear how other models would influence the role of NPs, PAs, and RNs. For example, geriatricians who provide care to nursing home residents in addition to their primary job in a hospital may be less present and therefore unable to fully support NPs, PAs, and RNs in nursing homes (40).

CONCLUSION

Skill mix change by introducing NPs, PAs, and RNs was organized in various ways. Despite this variation interviewees considered NPs, PAs, and RNs to be an added value to healthcare delivery. Introduction of these professionals changed the role of ECPs, mainly into a more coordinating role and focused on complex medical care issues. A clear and shared vision for roles, tasks, and responsibilities of NPs, PAs, and RNs was needed. A shared vision can contribute to greater acceptance of these providers and diminish the influence of personal factors of individual providers on how skill mix change is organized. It is important that all providers involved in skill mix change participate in discussions about vision, and the definitions of substitution and delegation and the legal consequences of transferring responsibilities are clear. Finally, a well-crafted vision might maximize the added value of NPs, PAs, and RNs and optimize the role of ECPs.

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Additional file Interview guides

Interview guide *monodisciplinary* focus groups interviews

1. What are your tasks in the nursing home?
   a. How does your position/occupation relate to the position/occupation of other professionals?
   b. What is your role in relation to other professionals?
   c. Who performs which tasks?
   d. Would you describe your tasks as substitution, delegation or supplementation?

2. What is the effect of skill mix change?

3. What are barriers and facilitators to skill mix change?
   a. What are chances, challenges, threats, conditions, and boundaries for skill mix change?

4. How should skill mix change be organized in the future?
What is your role in the future?
   a. Is it possible that another professional performs your tasks?
   b. Is it possible that you take over tasks from another professional?
   c. What will your position/occupation look like in 5 or 10 years?
   d. Who should perform which tasks?

Interview guide *interdisciplinary* focus group interview

Interviewees received beforehand a summary of the findings of the first round of (focus group) interviews.

1. Do you recognize the results of the first round of (focus group) interviews?
Are the results complete?

2. What is the optimal model of skill mix change (for the patient) in what circumstances?
   a. Why should skill mix change be organized in this way?
   d. Which professionals work together?
   c. What is the goal of skill mix change?

3. Why is the optimal model of skill mix change not yet a reality?

Topics to discuss:
- Tasks
- Responsibilities
- Effects of skill mix change
- Barriers and facilitators to skill mix change

CHAPTER 6

6

Substituting physicians with nurse practitioners, physician assistants or nurses in nursing homes: protocol for a realist evaluation case study

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Abstract

Introduction: In developed countries, substituting physicians with nurse practitioners, physician assistants and nurses (physician substitution) occurs in nursing homes as an answer to the challenges related to the aging population and the shortage of staff, as well as to guarantee the quality of nursing home care. However, there is great diversity in how physician substitution in nursing homes is modelled and it is unknown how it can best contribute to the quality of healthcare. This study aims to gain insight into how physician substitution is modelled, and whether it contributes to perceived quality of healthcare. Second, this study aims to provide insight into the elements of physician substitution that contribute to quality of healthcare.

Methods and analysis: This study will use a multiple-case study design that draws upon realist evaluation principles. The realist evaluation is based on four concepts for explaining and understanding interventions: context, mechanism, outcome, and context-mechanism-outcome configuration. The following steps will be taken: (1) developing a theory, (2) conducting seven case studies, (3) analysing outcome patterns after each case and a cross-case analysis at the end and (4) revising the initial theory.

Ethics and dissemination: The research ethics committee of the region Arnhem Nijmegen in the Netherlands concluded that this study does not fall within the scope of the Medical Research Involving Human Subjects Act (WMO) (registration number 2015/1914). Before the start of the study, the Board of Directors of the nursing home organizations will be informed verbally and by letter and will also be asked for informed consent. In addition, all participants will be informed verbally and by letter and will be asked for informed consent. Findings will be disseminated by publication in a peer-reviewed journal, international and national conferences, national professional associations and policy partners in national government.

INTRODUCTION

Maintaining the quality of nursing home care in light of the aging population and the shortages of staff is an important issue in developed countries. Physician substitution is one of the potential solutions used by nursing homes to deal with these challenges (1-3). However, there is great diversity in how physician substitution in nursing homes is modelled and it is unknown how it can be done best to contribute the most to the quality of healthcare (4).

Physician substitution means shifting care from physicians to nurse practitioners (NPs), physician assistants (PAs), or registered nurses (RNs), also called mid-level providers. We use the term mid-level providers to refer to professionals with European Qualification Level five or higher (5). Their introduction in nursing homes has happened for several reasons.

1) The population is aging, and in this aging population, the prevalence of (chronic) diseases and multi-morbidity is also expected to increase (6).
2) Societal reforms have shifted healthcare from the hospitals and nursing homes to the community (7). This means that only patients requiring complex care will reside in nursing homes. As a consequence, attending physicians in nursing homes face heavy workloads (8). In the Netherlands, nursing home physician specialists, called elderly care physicians (ECPs), are employed by the nursing home organization (9, 10). This is a unique specialty that may contribute to the quality of healthcare (9, 11, 12). However, there is also a high workload for ECPs in the Netherlands, and there are many vacancies (13).
3) Relatively few medical students are pursuing careers in healthcare for older people (13-16). By substituting physicians with mid-level providers, these threats to the quality of healthcare may be de diminished (2).

A systematic literature review showed that substituting physicians with mid-level providers in nursing homes appeared to achieve patient outcomes and process of care outcomes that were at least as good as care provided by physicians only (17). In addition, a focus group study with care providers of Dutch nursing homes showed that mid-level providers not only substituted for the physicians, but that they had a surplus value, according to the respondents, because they contributed to quality of healthcare, provided patient-centred care and strengthened the care team (4). However, the same study showed that there was great diversity in how physician substitution was modelled and there was no consensus on the optimal way to model physician substitution. Moreover, the results of this focus group study may be distorted by social desirability bias due to self reporting of activities (4). To gain a more complete and in-depth insight into physician substitution in

nursing homes, a multiple-case study will be carried out in seven nursing homes in the Netherlands. This paper describes the study protocol.

Study aim

The aim of the study is to gain insight into how substitution of ECPs by mid-level providers is modelled and whether it contributes to perceived quality of healthcare. Second, we aim to provide insight into elements of substitution of ECPs by mid-level providers that contribute to quality of healthcare (i.e. elements that contribute to an optimal model of physician substitution). In order to do so, the following research questions will be answered:

Research questions:

- How is substitution of ECPs by mid-level providers modelled in different nursing homes?
- What mechanism of substitution of ECPs by mid-level providers contributes, in what context and in what respect, to perceived quality of healthcare for nursing home patients?
- What are elements that contribute to an optimal model of substitution of ECPs by mid-level providers?

DESIGN

The study will use a descriptive and partial explanatory multiple-case study design that draws upon realist evaluation principles (18, 19). The realist evaluation is useful for studying complex interventions when the aim of the study is not determining whether an intervention is effective or not, but instead to explain how and why it is effective, under what conditions, and for which groups of patients (20). The realist evaluation is based on four concepts for explaining and understanding interventions: context (C), mechanism (M), outcome (O), and the context-mechanism-outcome (CMO) configuration. The realist evaluation is a pragmatic alternative to the experimental paradigm, given the impossibility of controlling complex interventions, such as physician substitution (20). The following steps will be taken in this study:

1. developing an initial theory (see below);
2. conducting seven case studies (collecting data on (appropriate) contexts, mechanisms and outcomes);
3. analysing outcome patterns after each case and a cross-case analysis at the end to see which can and which cannot be explained by the initial theory;
4. revising understanding of CMO configurations as a prelude to a further theory refinement.

INITIAL THEORY SUBSTITUTION

In the following paragraphs, a theory of substitution of ECPs by mid-level providers in nursing homes will be presented according to the concepts of the realist evaluation (19). Realist evaluation starts with eliciting and formalizing the theory to be tested. In addition, data will be collected and analysed, and the theory will be tested (20). The initial theory presented is partly based on literature and partly on a focus group study we performed (4). In the focus group study, ECPs, NPs, PAs, and RNs (in total, 35 care providers) working in Dutch nursing homes were interviewed about the topic of physician substitution. The theory is a preliminary theory that will be adjusted and further developed in this case study. Below, it is presented under the headings Mechanisms, Contexts and Outcomes, starting with the heading Mechanisms, as this is the core of CMO configurations. This theory (depicted in Figure 1) will be the starting point for the case study. If no reference is provided the information is based on our focus group study (4).

Mechanisms

Mechanism describes what it is about the intervention that brings about any effect (20). Below are presented three head mechanisms. Figure 1 presents the underlying mechanisms.

Mechanism 1:
Based on their education and previous experience, mid-level providers are able to substitute for ECPs largely autonomously with at least maintenance of the quality of healthcare.

In the Netherlands, NPs were introduced in the late 1990s (21). NPs are RNs with completed advanced education and clinical training on a master's level. They can provide a wide range of preventive, chronic healthcare and acute healthcare in a wide variety of clinical areas. While NPs combine nursing care with medical care, PAs mainly provide medical care (22). PAs were introduced in the Netherlands in the early 2000s (23). The PA course is a graduate program that leads to a master's degree and the program consists of a didactic phase and a clinical phase (23). PAs work across a wide range of healthcare settings and in a wide variety of clinical areas. Following the example of general practices, more and more practice nurses started working in nursing homes in the Netherlands the last decades (24). Practice nurses in nursing homes are nurses with additional training on older patients and the nurse's role in nursing homes. NPs, PAs and practice nurses all have the potential to reduce ECPs' workload and to contribute to the quality of healthcare in the unique multidisciplinary nursing home setting in the Netherlands (25, 26).

NPs and PAs are able to substitute for ECPs (27-30). PAs mostly substitute for ECPs to a large extent with regard to medical tasks, while the extent to which NPs can substitute for ECPs varies from a smaller to a larger extent. In addition, the level of autonomy of the

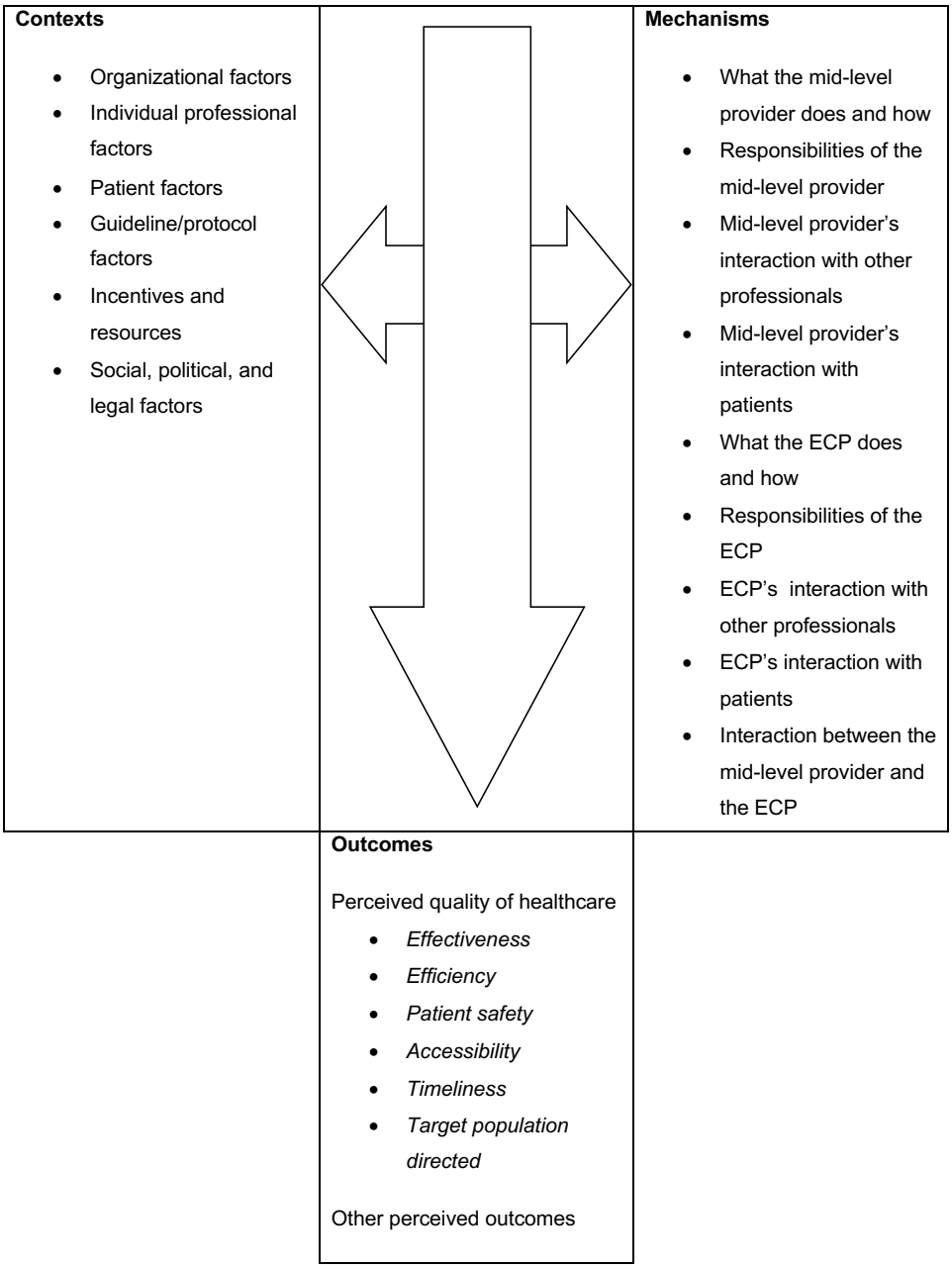

Figure 1 Interpretive framework of substitution of elderly care physicians (ECPs) by mid-level providers

NP/PA in the medical domain varies from one nursing home to another (31). PAs mostly have a high level of autonomy; they perform most of their tasks independent of an ECP. The level of autonomy of NPs varies. NPs/PAs can work at all different units of a nursing home: units for patients with physical disabilities, dementia special care units, or geriatric rehabilitation units, or a combination of different units. Tasks that can be replaced from ECPs to NPs or PAs are: admission of patients, assessment and management and follow-up of patients with a variety of chronic conditions, as well as acute conditions, determining patients' care plan, visits, multidisciplinary meetings, family meetings, procedures such as prescription of medication, referral to other disciplines, out of hours care and so on (26, 27, 29). Furthermore, some NPs/PAs in nursing homes work as a specialist at the organizational level (22, 26). Some PAs work as a specialist in addition to their work as a generalist, while some NPs only work as a specialist. Examples of specialist areas are: wound care, pressure ulcers and diabetes mellitus.

Practice nurses can also substitute for ECPs (26). The extent to which they can be a substitute on medical tasks and their level of autonomy in the medical domain is mostly lower than is the level of autonomy of NPs/PAs. Practice nurses mostly work at units for patients with physical disabilities or dementia special care units. They may work at one or more units in the organization and they may work as a specialist at the organizational level (26). Tasks they can perform are: visits (in preparation for the ECP's visit), triage, wound rounds and so on (26).

Although the above indicates that physician substitution in nursing homes is possible, it also indicates that there is great diversity in how it is modelled and the elements of an optimal model are unknown.

Mechanism 2:
Physician substitution always is a collaboration between the mid-level provider and the ECP to guarantee quality of healthcare. The role of the ECP changes due to this collaboration.

The level of collaboration between mid-level providers and the ECP varies. In some cases, the NP/PA has structural meetings with the ECP, while in other cases, the NP/PA only consults with the ECP if needed (26, 29). Practice nurses perform most of their tasks under supervision of ECPs (26). Trust and a 'personal click' seem to be important factors for a successful collaboration.

By shifting care to mid-level providers, the ECPs can spend more time on complex care or special areas of attention, such as palliative care. For less complex care, the role of the ECPs will become more of a coordinating role due to substitution of ECPs by mid-level providers. Furthermore, the ECPs are able to provide care to older adults living at home

as a consultant for the general practitioner. Although physician substitution releases the burden on ECPs during the day, the burden during evening, night and weekend shifts may increase because, in most cases, mid-level providers are employed instead of an ECP but they do not participate in these off-hours shifts (resulting in the same number of shifts with fewer people).

Mechanism 3:
Mid-level providers have a different way of working and they perform additional tasks compared to ECPs, which may lead to an increased quality of healthcare.

During the performance of their tasks, mid-level providers show, to a more or lesser extent, the following characteristics: closeness to the patient/family, strengthening of the care team, and acting as a bridge between the ECP and the care team and the patient or the family (22, 26, 29, 31). NPs and practice nurses show these characteristics more than do PAs (21). In addition to the patient-related tasks, mid-level providers perform non-patient-related tasks as well, such as teaching and coaching of the care team, innovation of healthcare, and innovation of the organization of healthcare (26-31).

Contexts
The context are those features of the conditions that are relevant to the operation of the mechanism (20).

The factors that influence the level of physician substitution and the role of the mid-level provider in nursing homes can be classified according to the seven domains of the 'Tailored Implementation for Chronic Diseases' checklist: (1) organizational factors; (2) individual professional factors; (3) patient factors; (4) guideline factors; (5) incentives and resources; and (6) social, political, and legal factors (17, 31, 32). The seventh domain, 'professional interactions', is seen as part of the mechanism.

Organizational factors
Organizational factors that influence the level of physician substitution are the demographics of an organization (e.g. number of patients), the vision of the organization on physician substitution and how the mid-level provider is positioned in the organization. For example, in an organization with a shortage of ECPs, the role of the mid-level provider (to substitute the ECP) will be mainly focused on care delivery, which might be different than in an organization without a shortage of ECPs, where the role of the mid-level provider may be more focused on quality improvement. In addition, whether or not mid-level providers and ECPs form fixed couples or rotate influences the consistency of care and the level of trust in one another (17). Furthermore, some nursing homes introduce the mid-level provider in their organization without a clear vision of their role; this may

hinder the implementation of physician substitution as the role of the mid-level provider is not clear to ECPs. When mid-level providers are positioned in the nursing team, their role will be different from cases in which mid-level providers are positioned in the medical team next to the ECP, which facilitates physician substitution. Another important factor is that the position of the mid-level provider needs time to embed in a nursing home organization.

Individual professional factors

Individual professional factors influence the role of the mid-level provider, especially the characteristics of the mid-level provider him/herself, of the ECP, and of the care team and other care providers. Characteristics of the mid-level provider him/herself are, for example, type of mid-level provider (NP, PA or practice nurse: see 'Mechanisms' section), background and level of experience. A pioneering spirit, ability to work independently, thirst for knowledge and willingness to shape his or her own practice contribute to successful implementation of the mid-level provider position (17). In addition, the willingness of the ECP to substitute tasks shapes the role of the mid-level provider (17). An example of a characteristic of the care team, which influences the role of midlevel providers, the level of education. If this level is low, the mid-level provider will be inclined to work in the nursing domain instead of the medical domain. The level at which other care providers accept the mid-level provider also influences their role and the ease of performing their role.

Patient factors

Characteristics of the patients that influence the role of midlevel provider are, for example, their type of care needs. In the Netherlands, there is a difference between units for patients with physical disabilities and dementia special care units, and geriatric rehabilitation units are often part of a nursing home (25). Mid-level providers may work at all units; however, the type of unit determines their tasks. Another characteristics of patients can include their familiarity with the function of mid-level providers; if they are not familiar, they might demand to be taken care of by an ECP (17).

Guideline factors

Substitution of ECPs by mid-level providers is strongly influenced by the agreements, or lack thereof, made regarding substitution. Examples of agreements are vision on physician substitution, job description of the mid-level provider, collaborative agreements and treatment protocols that are adjusted to the mid-level provider based on the scope of practice.

Incentives and resources

Appropriate financing is an important factor for successful implementation of the mid-level provider in nursing homes (17). This includes financing at the organizational level

– how the employment of a mid-level provider is reimbursed – and at professional level, remuneration that is appropriate for the task and responsibilities of the mid-level provider.

Social, political, and legal factors

The support of the mid-level provider as an ECP substitute from the professional association of ECPs is an important factor related to the acceptation of mid-level providers. Political and legal factors are also context features of physician substitution. These factors determine the boundaries of mid-level providers' authorisation and they determine when, how, where, and by whom healthcare for older people is provided (17). In the Netherlands, NPs and PAs are authorised to indicate and perform some of the so-called 'reserved procedures' described in the Individual Health Care Professions Act, which were initially only reserved for physicians. Furthermore, NPs and PAs are not authorised to sign death certificates (33, 34). Practice nurses are only allowed to perform reserved procedures after instructions from a physician, NP or PA. In addition, the aging population and the societal reforms that shift care from the hospital/nursing home to the community influence the way mid-level providers are employed.

Outcomes

Outcome patterns are comprised of the intended and unintended consequences of the intervention (20).

The outcomes of physician substitution will be discussed as outcomes related to quality of healthcare based on the six concepts of quality of healthcare defined by the Ministry of Health, Welfare and Sport of the Netherlands and the World Health Organization: (1) effectiveness, (2) efficiency, (3) patient safety, (4) accessibility, (5) timeliness, and (6) target population directed (35, 36).

Effectiveness

Effectiveness refers to delivering healthcare that is adherent to an evidence base and results in improved health outcomes for individuals and communities, based on needs (35, 36).

Substitution of ECPs by NPs or PAs seems to have a neutral effect on or cause a reduction in the number of hospital admissions, hospital days, emergency department visits, mortality, and number of medications used.[16] The effectiveness of substitution of ECPs by practice nurses is unknown.

Efficiency

Efficiency refers to healthcare that avoids waste (35, 36).

Physician substitution appears to have a mixed effect on healthcare utilization (costs) (17). However, if mid-level providers perform the same activities as an ECP, they do this at lower costs because of their lower salary. In contrast to this, mid-level providers hardly

ever fully replace ECPs (26). The NP may supply a time savings for the ECP of between 40 and 88% and the practice nurse, between 35 and 72% (26). The time savings a PA supplies is unknown. It is unknown how the lower costs (salary) of mid-level providers relate to the substitution percentage in terms of efficiency. In addition, mid-level providers contribute to efficiency as they work in a structured manner and take into account the organization of care while planning care activities.

Patient safety

Patient safety refers to avoiding harm during healthcare interventions (35, 36).

Mid-level providers seem to be able to substitute for ECPs in terms of maintaining patient safety within their boundaries and if an ECP is available for support if needed. In addition, mid-level providers might detect medical problems early because they are regularly present on the units. They might also focus on the quality policy, such as developing protocols and stimulating working according to these protocols (26).

Accessibility

Accessibility refers to how easily someone obtains access to healthcare, which does not vary in quality because of personal characteristics such as gender, race, ethnicity, geographical location, or socioeconomic status (35, 36).

Mid-level providers may enhance the accessibility of medical care. They are easily accessible to the care team as well as for patients and family because they are often present at the unit, and have an open attitude (26).

Timeliness

Timeliness refers to providing healthcare in time (35, 36).

NPs appear to provide as many progress visits as ECPS, while NPs perform more acute visits.[16] In addition, mid-level providers may have/take more time for direct patient care than do ECPs.

Target population directed

Target population directed refers to respecting the preferences, needs, and values of the target group (35, 36).

Mid-level providers may contribute to target population directness because they know their patients very well, involve family in decisions, and communicate with patients and family on their own level.

Other outcomes ('indirect outcomes' (20))

Mid-level providers may contribute to the continuity of care as they work at one place for a long time (26). In addition, the fact that mid-level providers perform different tasks and have a different way of working than ECPs may lead to better quality of healthcare,

but also to other outcomes. For example, coaching of the care team during a training may lead to increased knowledge of the care team. As the goal of this study is to describe physician substitution, we did not focus explicitly on 'indirect' outcomes, but they might be discussed in answers to our open interview questions and then will be included in the analysis.

METHODS

Case selection

The goal of a case study is not statistical generalization, but analytic generalization. This means that the initially developed theory is used as a template with which the empirical results of the case study are compared. Each case must be adequately selected so that it either (1) predicts similar results (literal replication) or (2) predicts contrasting results for anticipated reasons (theoretical replication) (18). In this study, each case will be comprised of one mid-level provider in a nursing home organization. The first mechanism: mid-level providers can substitute for ECPs largely autonomously, at least in terms of maintenance of quality of healthcare. This is the mechanism we are most interested in and therefore, this mechanism will guide the case selection. The main goal of the selection is to select cases in which the mid-level provider works mainly in the medical domain. To gain insight into whether or not mid-level providers can substitute for ECPs largely autonomously, at least in terms of the maintenance of quality of healthcare, we will seek variation on the level of autonomy. We will also seek variation on other factors of the first mechanism. See Table 1 for a description of the selection criteria.

The professional associations of NPs, PAs, and practice nurses in nursing homes will be asked to distribute a questionnaire among their members (NPs: 224, PAs: 30, practice nurses: 180). This questionnaire contains questions about the inclusion criteria and the maximum variation criteria. Reminders will be used to enhance the response rate. The completed questionnaires will be used to select seven cases. The number of seven was chosen to create a balance between depth and variation in the study with the given budget and time available.

Setting

The setting will be seven nursing home organizations in the Netherlands that have one or more locations, and the (different) unit(s) where the mid-level providers work.

Table 1 Selection criteria

Inclusion criteria
• > 65% of the patient related tasks[1] the mid-level provider performs should be in the medical domain[2], according to the mid-level provider's own estimation.
• The mid-level provider should be employed for minimal 0,6 full time equivalents.
• ≥80% of the patients the mid-level provider takes care of should be 65 years or older.
• If possible (depending on the available cases) the mid-level provider should be working for > 2 years as a mid-level provider in a nursing home.
Maximum variation criteria
• Level of autonomy[3] (>70%/<70%), in the performance of patient-related tasks in the medical domain, according to the mid-level provider's own estimation.
• Working as a generalist, or a specialist, or both.
• Working at ward level, or at organizational level, or both.
• Working at ward for patients with physical disabilities, dementia special care unit, or geriatric rehabilitation unit, or a combination of different units.
• Type of mid-level provider (nurse practitioner/physician assistant/practice nurse).
• Male, female.

[1] Patient-related tasks: direct patient-related tasks and indirect patient-related tasks: Direct patient- related tasks: tasks that are performed in presence of/with the patient and/or family. Indirect patient-related tasks: tasks that are performed for the patient, but not per se in presence of the patient.

[2] Medical domain: medical examination of the patient (history, physical examination etc.), medical diagnostics, formulate a medical treatment plan, indicate and/or perform medical procedures (prescription of medication, perform surgical procedures, give injections etc.).

[3] Autonomy: independent indication and performance of patient related tasks in the medical domain. The performance can also be delegated to another care provider. Consultation with an elderly care physician is possible, but the mid-level provider is responsible.

Participants

The participants will be:

- the mid-level provider;
- the manager that has been/is involved the most in the decision to substitute for ECPs;
- the supervisor/manager of the mid-level provider;
- the head ECP;
- all ECPs with whom the mid-level provider collaborates directly;
- five nurses/healthcare assistants/nursing team leaders with whom the mid-level provider collaborates;
- five patients the mid-level provider takes care of and their informal caregiver; (at dementia special care units; only informal caregivers will participate);
- patient council, family council or patient-family council.

Data collection

Before the start of the study, the Board of Directors of the nursing home organizations will be informed verbally and by letter and they will be asked to provide informed consent for the entire study. In each case, two researchers (MLo and IM) will collect all data in 2 weeks. Data collection will consist of observations, interviews, questionnaires and documents (see Table 2). All interviews will be audio-taped and transcribed verbatim. Data will be collected between September 2015 and January 2017.

Informed consent

All participants who will be interviewed will be informed verbally and by letter and will be asked to provide informed written consent. A contact person (e.g. manager, nursing team leader) and/or the mid-level provider will assist in identifying all participants. The contact person will draw a random sample of five nurses/healthcare assistants/nursing team leaders. With the help of the contact person and/or the mid-level provider, patients will be selected for an interview. Five patients who are 65 years or older and mentally competent (according to the judgement of the contact person or the mid-level provider) will be asked for an interview, together with his/her informal caregiver. On dementia special care units, only the informal care giver will be interviewed. In addition, the patient/family council will be contacted via the mid-level provider and the members will be invited for a focus group interview, as well as to sign an informed consent.

Before the start of the study, all patients, informal caregivers and care providers of the units where observations will take place, will be informed about the study and the observations, so they have the chance to object to the observation in advance. The method for informing participants about the observations will be determined in collaboration with our contact person and the Board of Directors.

During the observations, all patients that the mid-level provider and the ECP visit will receive brief information about the study and then will be verbally asked for informed consent to observe the contact with the mid-level provider or ECP (i.e. a written informed consent form will not be used). This will be the same for all care providers that the mid-level provider/ECP has contact with during the observations.

Observations

Observational guides are developed based on the framework depicted in Figure 1. The mid-level provider will be observed for 4 days x 4 hours within the 2-week period and the ECP for 2 days x 2 hours within the 2-week period. These time periods have been chosen as it is anticipated that an observation of 2 or 4 hours gives a good impression of the tasks the mid-level provider and the ECP perform. By planning multiple observations the chance of only observing exceptional situations is diminished. The mid-level provider will be observed for a longer period of time as he/she is the subject of the study.

Table 2 Data collection

Sources of data	Data
Mid-level provider (three NPs, two PAs and two practice nurses)	• Observation (4x4 hours) • Questionnaire • Interview (after observation)
Manager involved in physician substitution	• Questionnaire • Interview
Supervisor/manager of the mid-level provider	• Interview
ECP with whom the mid-level provider collaborates most intensely	• Observation (2x2 hours) • Questionnaire • Interview (after observation)
ECPs with whom the mid-level provider collaborates directly	• Questionnaire • Interview
Head of the ECPs	• Interview
Five nurses/healthcare assistants/nursing team leaders with whom the mid-level provider collaborates	• Interview
Five patients the mid-level provider takes care of and/or their informal caregiver	• Interview
Patient council, family council or patient-family council	• Focus group interview
Documents	• Mission and vision of the organization; • Mission and vision of the organization on physician substitution; • Job description of all mid-level providers in the organization and of the ECP; • Working arrangements for the mid-level provider and the ECP; • Treatment protocols for the mid-level provider; • Annual report of the organization of the preceding year; • Information about the mid-level provider for patients and family.

ECP = elderly care physician, NP = nurse practitioner, PA = physician assistant

In addition, within the observation of the mid-level provider all scheduled contact moments between the mid-level provider and the ECP will be observed. The ECP will be observed to discover differences or similarities in performing the tasks they have in common with the mid-level provider. Observations will be planned in advance based on indication of the mid-level provider and the ECP which time they perform the most patient related tasks. Both researchers will carry out half of the observations. The role of the researcher during observations will be as a non-participant.[36] In non- participant observation, it is important to find a balance between building trust among the participants and 'going native'. The relatively short observation periods will prevent the observers 'going native'. The observational instrument consists of two parts. In one part, the researcher will write down what tasks the mid-level provider performs and how he/she performs these tasks. In the second part, the researcher will write down a general impression on topics such as level of autonomy and care for the client/family after each observation moment. The field notes in the first part of the observation instrument can be used to fill out the second part. After each observation moment, the researcher will directly type out the field notes on a computer.

Interviews and questionnaires

The interview guides will be developed based on the framework depicted in Figure 1, with a different focus for each group of participants. The interview with the mid-level provider will be very extensive and will focus on all relevant items; the interview with the manager will mainly focus on the vision of the organization on physician substitution and the interview with patients and/or their informal caregiver will mainly focus on their needs and their experiences with the mid-level provider. Tasks and responsibilities will be collected via a questionnaire for the mid-level provider and the ECPs with whom the mid-level provider collaborates directly. The specific outcomes (see Figure 1) will be inquired about in the interviews with the mid-level provider, the ECPs with whom the mid-level providers collaborate directly, and the nurses/healthcare assistants/nursing team leaders with whom the mid-level provider collaborates. Participants will be asked to compare the mid-level provider and the ECP on all of these outcomes. In the other interviews, outcomes will be discussed in general. In addition, all participants, except for the patients and/or their informal caregiver and the patient/family council, will be asked whether they perceive the way physician substitution is modelled as being optimal and why they think so or not. They will also be asked whether they would recommend it to other organizations and why they would or would not. After analysis of each case, a member check (confirmatory focus group interview) will be carried out. See 'Data analysis' section for further details.

DATA ANALYSIS

Data will be analysed in the 5 weeks directly after data collection of each case. At completion of the initial analysis of all cases at the end of the study, a cross-case analysis will be carried out.

The data analysis will rely on theoretical propositions and explanation building. This means that the theoretical propositions (the initial theory) that led to this case study will be followed and that the analysis aims to answer the questions: (1) How is substitution of ECPs by mid-level providers modelled in different nursing homes?, (2) What mechanism of substitution of ECPs by mid-level providers contributes, in what context and in what respect, to perceived quality of healthcare for nursing home patients?, and (3) What are elements that contribute to an optimal model of substitution of ECPs by mid-level providers?

Single case analysis

Qualitative analysis

The tasks in the first part of the observation instrument will be coded according to the possible tasks described in advance. However, there is also space for tasks that are not described in advance. Each observation moment will be coded by one researcher and checked by the other.

The two researchers who collect the data (MLo and IM) will compare their notes in the second part of the observation instrument – the general impression. Differences will be discussed, and finally, they will make an assembly of the different forms. If no consensus can be reached, they will ask clarification during the member check (see below).

Four researchers (MLo, IM, AvV and LvD) will qualitatively analyse the interviews and documents. MLo will code all interviews. In the first case, a second researcher will independently code all interviews. If sufficient consensus is reached in the coding, for the next cases, half of the interviews will be coded independently by a second researcher; for the other half, MLo's codes will be checked by another researcher. The computer program ATLAS.ti will be used for analysis. Content analysis will be used to analyse the data (38). This is a method to attain both condensed and broad descriptions of a phenomenon by analysing text data (38). The developed theory of context, mechanism and outcome will be tested using deductive coding. This means that a structured categorization matrix based on Figure 1 will be used. However, aspects that do not fit the categorization matrix will be used to create new categories based on the principle of inductive content analysis (38).

The researchers who collect the data will use the method of 'outlining the main message' (39). The researchers will pretend that the deadline to hand in the final case description is imminent and they will ask themselves the question: how would the main message of this case be formulated (39). This question focuses the researcher to think about the content of the result section. Both researchers will do this independently during analysis and they will compare and discuss their main message. In addition, they will check their main message with the data collected.

Quantitative analysis

The questionnaires and the quantitative parts of the interviews (demographic data) will be quantitatively analysed. The computer program SPSS Statistics 20 will be used for analysis. Data will be analysed using descriptive statistics.

Member check

For each individual case, MLo will write a case description and the other researchers will check it. This description will build on the theoretical propositions made at the start of this case study. This description will be used for a member check within the case (39, 40). The mid-level provider, the ECP that has been observed, the manager involved in physician substitution, the manager/supervisor of the mid-level provider and two members of the care team will be asked to read the case description. In a focus group, these participants will be asked whether the case description is an accurate description of their case and clarification on the parts that turned out to be unclear will be asked. The member check has some drawbacks, such as participants struggling with abstract synthesis, participants that want to change their initial response and participants with different views on the same data (41). To face these drawbacks, a focus group will be organized so that the interaction process can provide additional information, helping to make it clear why someone struggles with abstract synthesis, why someone has changed his or her mind or why participants have different views. All of this information will enrich the case description. The information gathered during the focus group will be used to further develop the case description.

Cross-case analysis

When the initial analysis of each case is completed, the process of realistic cumulation will begin (19). This means a motion up and down the ladder of abstraction and specification; the data gathered will be used to further develop the 'abstract' theory of physician substitution in nursing homes. The cross-case analysis will go beyond the separate Cs, Ms and Os. For each case, the CMO configurations will be determined based on the initial analysis by answering questions like which elements of the mechanism and the context give what outcomes. These CMO configurations will be developed at case level. Where outcomes are unknown, anticipated outcomes (in line with the collected data) will be

formulated. In addition, CMO configurations across cases will be determined (42, 43). At the end, these CMO configurations will help us answer the research questions.

VALIDITY AND RIGOR

The trustworthiness of the study findings is based on the following four criteria: (1) credibility, (2) dependability, (3) confirmation and (4) transferability (40).

- Credibility will be ensured by the selection of seven different cases according to inclusion criteria and maximum variation sampling. In addition all relevant stakeholders involved in physician substitution will be included and a member check will be performed in each case. The collection of different types of data, known as data triangulation, also contributes to the credibility. To diminish the observer effect (37), the researchers will explain to the care provider being observed that there is no good or bad behaviour and that the goal of the observation is only to describe the case and not to judge the behaviour.
- Dependability will be promoted by thoroughly analysing and involving all researchers in the cross-case analysis.
- Confirmation will be enhanced by keeping a logbook on methodological issues, in addition to memos reflecting on their role during the observations and interviews. Both researchers are health scientists with a nursing background. They are aware of the fact that their background may cause them to focus more on the nursing domain than on the medical domain during data collection and analysis.

During non-participant observations, it is a challenge to remain objective and not selective (37). Dealing with this challenge starts with acknowledging that an observer can never be truly objective and will always be somewhat selective (44). Objectivity will be enhanced through the collection of field notes from two researchers, observations during different moments, structured data collection, check of the observers' ideas on the main message relative to the collected data, discussions of the findings in the research team, and the member check.

Prior to the start of the case study and the research proposal, the observation instruments were tested by the two researchers (MLo and IM) using an ECP and an NP, both for 4 hours. After the observations, they discussed and compared their field notes and discussed their role during observations. After this test, they made changes to the observation instruments, in addition to making decisions on the focus during observations (the mechanism) and on their role during observation (e.g. introduce oneself with a handshake). By performing the test, the researchers developed the observation instrument, as well as establishing themselves as a data collection instrument.

- Transferability: a general description of the organizations that provides sufficient information to implement a similar role and model of care will be presented in the paper to be published.

DISCUSSION

This case study will provide insight into how substitution of ECPs by mid-level providers is modelled in different nursing homes and what mechanism contributes in what context and in what respect to quality of healthcare for older people. In addition, it will give input for the most optimal model of physician substitution in nursing homes. As stated in the preliminary theory, the model might strongly depend on the context, so there might be no single best model. Furthermore, each model studied in this case study might have strong and weak parts. Therefore, the most optimal model (for a given context) might consist of a combination of parts of different models. Bryant-Lukosius and DiCenso developed the PEPPA framework: participatory, evidence-based, patient-focused process for advanced practice nursing role development, implementation and evaluation. This framework states that the role of an advanced practice nurses should be developed based on a needs assessment and clear goals, objectives and outcomes identified (45). A model might be optimal if the role of a mid-level provider is developed in this manner. In addition to this framework, this case study will provide some concrete examples of this general statement and concrete preconditions of implementing a mid-level provider.

This study is conducted in the Netherlands and it is important to point out that the nursing home setting might differ from other countries. In the Netherlands, multidisciplinary teams are employed by the nursing home organizations, including the ECP, physiotherapist, occupational therapist, speech therapist, dietician and psychologist (9, 10, 46). This means that all these providers are full time present at the nursing home and not only on call. Worldwide the employment of a broad multidisciplinary team is unique, especially the presence of an ECP as a medical specialist in elderly care (8, 46). The cooperation between the Dutch ECPs and the relatively new mid-level providers will be influenced positively as well as negatively, as it is facilitated by the presences of the ECP, but possibly hindered by competition. The interaction between the ECP and the mid-level provider and how this interaction influences physician substitution is part of the current study in observations as well as in interviews, resulting in recommendations on how to strengthen the cooperation.

Besides the differences in the nursing home setting, there is also a huge difference in the extent of substitution of physicians by NPs and PAs between countries. As in other countries, PAs in the Netherlands mainly focus on the medical domain, while NPs combine the medical with the nursing domain. In the Netherlands, NPs and PAs are educated at the

master's level, they have a protected title and are authorised to indicate and perform some of the so called 'reserved procedures', like prescribing medication and giving injections (33, 34, 47). Research shows that in some countries (like Australia and the USA) NPs are able to substitute physicians like in the Netherlands, while in other countries (like France and Germany) they are not (48). For PAs applies that like in the Netherlands they are also recognised in Australia, Canada, the UK and the USA, but in these countries they are only allowed to work under a supervising physician (23).

This case study will build on a theory based on the literature and a focus group study conducted by the research team. The challenge of performing a case study with certain propositions is to keep an open mind while collecting data (18). Although the theory will guide data collection and analysis, it must not confine the data collection and analysis process; there has to be room for alternative hypotheses. The research team will face this challenge by being aware of a vision that is too narrow during data collection and discussing the theory and alternative hypotheses in regular meetings. In this case study, all outcomes are perceived outcomes and no quantitative outcomes are measured. This should be taken into account while interpreting the results. It might be that we cannot 'complete' some CMO-configurations because the outcome of a certain mechanism in a certain context is not fully clear. However, this case study will provide insight into the possible outcomes related to physician substitution in nursing homes, which might inform further research.

The results of this case study will inform care providers, managers and policy administrators in their decisions regarding how to substitute mid-level providers for ECPs in nursing homes in a way that contributes most to perceived quality of healthcare for older people.

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CHAPTER 7

Substituting physicians with nurse practitioners, physician assistants or nurses in nursing homes: a realist evaluation case study

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Objectives: This study aimed to gain insight into how substitution of elderly care physicians (ECPs) by nurse practitioners (NPs), physician assistants (PAs) or registered nurses (RNs) in nursing homes is modelled in different contexts and what model in what context contributes to perceived quality of healthcare. Second, this study aimed to provide insight into elements that contribute to an optimal model of substitution of ECPs by NPs, PAs, or RNs.

Design: A multiple-case study was conducted that draws on realist evaluation principles.

Setting: Seven nursing homes in the Netherlands

Participants: The primary participants were NPs (n=3), PAs (n=2) and RNs (n=2), working in seven different nursing homes. As secondary participants were included: ECPs (n=15), medical doctors (MDs) (n=2), managing directors/managers/supervisors (n=11), nursing team members (n=33), and residents/relatives (n=78).

Data collection: Data collection consisted of 1) observations of the NP/PA/RN and an ECP/MD, 2) interviews with all participants, 3) questionnaires filled out by the NP/PA/RN, ECPs/MDs, and managing directors/managers, 4) and collecting internal policy documents.

Results: An optimal model of substitution of ECPs seems to be one in which the professional substitutes for the ECP largely autonomously, well-balanced collaboration occurs between the ECP and the substitute, and quality of healthcare is maintained. This model was seen in two NP cases and one PA case. Elements that enabled NPs and PAs to work according to this optimal model were among others: collaborating with the ECP based on trust; being proactive, decisive, and communicative; and being empowered by organizational leaders to work as an independent professional.

Conclusions: Collaboration based on trust between the ECP and the NP or PA is a key element of successful substitution of ECPs. NPs, PAs, and RNs in nursing homes may all be valuable in their own unique way, matching their profession, education, and competences.

Abstract

BACKGROUND

Nursing home physician specialists face heavy workloads due to population aging, increased multimorbidity, and relatively few medical students pursuing a career in healthcare for older adults (1-3). In the Netherlands, nursing home physician specialists are called elderly care physicians (ECPs) and are employed by the nursing home organization (4-6). This is a unique specialty that may contribute to the quality of healthcare (5, 7, 8). However, there is a high workload for ECPs in the Netherlands and there are many vacancies (9, 10). At the moment, medical doctors (MDs) without any specific specialty partly fulfill these vacancies but often for a short time as they perceive this as interim employment (9). Substituting physicians with nurse practitioners (NPs), physician assistants (PAs), or registered nurses (RNs) is a possible solution to maintaining quality nursing home care. In the last decades, RNs, NPs, and PAs increasingly have been introduced into nursing homes to meet these challenges (11-13).

A systematic review showed that substituting nursing home physicians with NPs, PAs, or RNs appears to achieve at least as good resident and process of care outcomes as care provided by physicians (14). In a focus group study with professionals in Dutch nursing homes, the contributions of NPs, PAs, and RNs to quality healthcare, provision of resident-centered care, and strengthening of the care team was considered an added value (15). Nevertheless, the same study showed that physician substitution was organized by different professionals (NPs, PAs, RNs) with different tasks and responsibilities, and there was no consensus on optimal organization. Physician substitution is influenced by factors at the social, organizational, and individual levels (14, 15). For example: (a) at the societal level, the support of the professional associations; (b) at the organizational level, the vision on roles, tasks, and responsibilities of NPs, PAs, and RNs; and (c) at the individual level, physicians' willingness to share responsibility for resident care (14-15).

In short, it is known that there is great variation in how physician substitution is modeled, but we do not know what this variation looks like in practice. In addition, there is some knowledge about how physician substitution might bring about any effect, but it is not clear how contextual factors influence physician substitution and how this influences quality of healthcare. Therefore, we aimed to obtain detailed insight into the connected elements.

The following research questions are addressed in this paper:

- How is substitution of ECPs by NPs, PAs, and RNs modelled in different Dutch nursing homes?
- What mechanism of substitution of ECPs by NPs, PAs, and RNs contributes, in what context, and in what respect, to perceived quality of healthcare for nursing home residents?
- What elements contribute to an optimal model of substitution of ECPs by NPs, PAs, and RNs?

METHODS

We performed a realist evaluation, which is a method used to explain how and why a complex intervention is successful (16-18). In the current study, an initial theory about substituting physicians, articulated in three mechanisms, is evaluated through multiple cases. Those mechanisms describe what it is about a complex intervention (physician substitution) that brings about any effects (16). In figure 1 the underlying mechanisms are classified under the head mechanisms. Below the main methodological elements are reported. We refer readers to the published study protocol for an extensive description of this multiple-case study and the initial theory that is tested in this case study (19). The protocol and the current paper are reported according to the RAMSES II reporting standards for realist evaluations (20).

The research ethics committee of the region Arnhem Nijmegen concluded that this study did not fall within the scope of the Medical Research Involving Human Subjects Act (WMO) (registration number 2014/298).

Patient and public involvement

In this study the patients were represented by 'Zorgbelang Inclusief'. One of the advisors of 'Zorgbelang Inclusief' was a member of the advisory board of this study. 'Zorgbelang Inclusief' supports citizens, patients, care and welfare organizations, local authorities, insurance companies and educational institutions to strengthen self-reliance of people and increase quality of social, healthcare and welfare services. The advisor was involved in the design and conduct of the study. For example, in developing residents' interview guides and in assessing the burden of the interview.

Case selection

Each case comprised one NP, PA, or RN in a nursing home organization. From the 103 completed selection questionnaires (see protocol) we selected seven cases to create a balance between depth and variation in the study. The main goal of the selection was

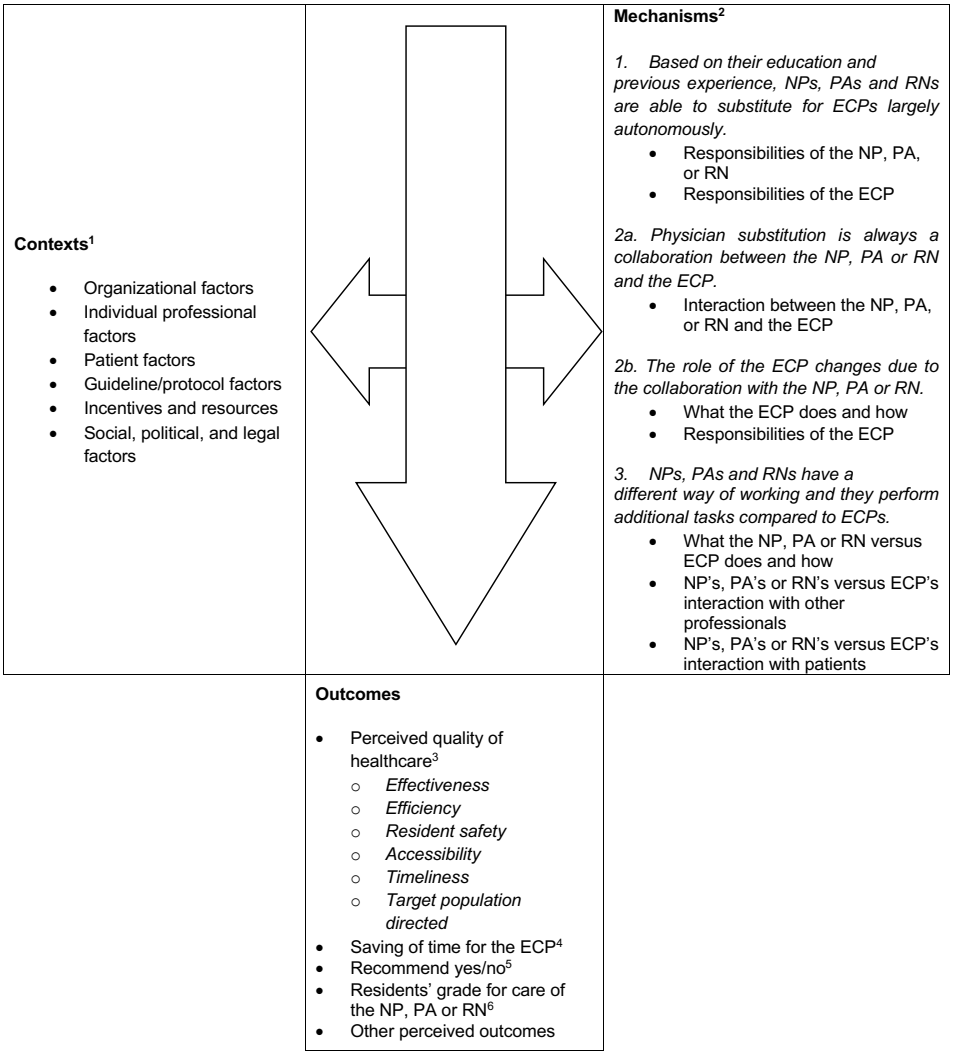

Figure 1 Framework of substitution of elderly care physicians (ECPs) by nurse practitioners (NPs), physician assistants (PAs), or registered nurses (RNs)

[1] What factors influence physician substitution and how?

[2] What is it about physician substitution that brings about any effect?

[3] What is the influence of the NP, PA or RN on (quality of healthcare outcome) in comparison to care provided by (the) ECP(s)?

[4] What is the percentage of saved time for the ECP of the time the NP, PA or RN works.

[5] Would you recommend the way physician substitution by the NP, PA, or RN is modelled in your organization to other organizations?

[6] How would you grade the care you receive from the NP, PA, or RN?

to select cases in which the professional worked mainly in the medical domain; that is, medical examination, medical diagnosis, and medical treatment. In addition, variation was sought on, among others, level of autonomy and type of professional. Maximum variation sampling was used to provide insight into different models of physician substitution and to select cases that did or did not confirm the head mechanisms.

Participants

The primary participants of interest were NPs, PAs, and RNs. We included a specific group of RNs, the practice nurses, as they are most likely to substitute for ECPs. Following the example of general practices, more and more practice nurses started working in nursing homes in the Netherlands in the last few decades (21). Practice nurses in nursing homes have additional training on the healthcare needs of older patients and on the nurse's role in nursing homes. As secondary participants we also included ECPs, managing directors/ managers/supervisors, five members of the nursing teams (i.e., nurses/healthcare assistants and nurse team leaders) and five nursing home residents and their relatives. Representatives of the residents and/or family council were also included in the study.

Data collection

Data collection consisted of observations, interviews, questionnaires, and analysis of internal policy documents. Table 1 presents the data that were collected in each case. All interviews were audio-taped, transcribed verbatim and anonymized before analyses. Atlas.ti V.7 and SPSS V.20 were used to facilitate data management and analyses. Data were collected between September 2015 and January 2017 in 7 nursing homes. In each case, two researchers (MLo and IM) collected all data in two weeks. Written informed consent was obtained from all participants who were interviewed and consent was asked before observation. For full informed consent procedure see published study protocol (19).

Data analysis

Data were analyzed by four researchers in pairs (MLo with IM, AvV or LvD) in the 5 weeks directly after data collection of each case. At completion of the initial analysis of all cases, a cross-case analysis was carried out by two researchers (MLo and AP). First context, mechanism, and outcome (CMO) configurations were formulated at case level. In addition, CMO configurations across cases were determined. These CMO configurations were discussed within the research team (the authors of this paper) (18).

Table 1 Data collection per case

Method	Specific data (see table 3)	Mechanism data	Context data	Outcome data
	NP, PA, RN			
Questionnaire	• Age, gender • Working experience • Type of unit(s) • Member of which team • Number of residents • Number of collaborating doctor(s) • Type of collaboration with doctor(s) • Level of autonomy • Tasks • Prescribing medication	1, 2a, 3	-	-
Observation (4 x 4 hours)	• Structural and/or ad hoc meetings with doctor(s) • Level of autonomy • Tasks • Prescribing medication	1, 2a, 3	• Individual professional factors • Patient factors	-
Interview; after observation	• Structural and/or ad hoc meetings with doctor(s)**)** • Level of autonomy • Tasks • Prescribing medication	All mechanisms	All context factors	All outcomes except grade
	Managing director/Manager involved in physician substitution			
Questionnaire	• Number of peers of the NP, PA or RN	-	-	-
	Managing director/Manager involved in physician substitution - Supervisor of the NP, PA, or RN - Head ECP			
Interview	• Reason to employ provider • Vision on substitution	All mechanisms	All context factors	Recommend yes/no
	ECP with whom the NP, PA, or RN collaborates most intensely			
Questionnaire	• Type of collaboration with NP, PA or RN • Level of autonomy of NP, PA or RN • Tasks of NP, PA or RN	All mechanisms	-	-

Table 1 *continued*

Observation (2x2 hours)	• Structural and/or ad hoc meetings with NP, PA or RN • Level of autonomy of NP, PA or RN	All mechanisms	• Individual professional factors • Patient factors	-
Interview; after observation	• Structural and/or ad hoc meetings with NP, PA or RN • Level of autonomy of NP, PA or RN • Tasks of NP, PA or RN	All mechanisms	All context factors	All outcomes except grade
ECPs with whom the NP, PA, or RN collaborates directly				
Questionnaire	• Type of collaboration with NP, PA or RN • Level of autonomy of NP, PA or RN • Tasks of NP, PA or RN	All mechanisms	-	-
Interview	• Structural and/or ad hoc meetings with NP, PA or RN • Level of autonomy of NP, PA or RN • Tasks of NP, PA or RN	All mechanisms	All context factors	All outcomes except grade
Five nurses/healthcare assistants/nursing team leaders with whom the NP, PA, or RN collaborates				
Interview	-	All mechanisms	All context factors	All outcomes except grade
Five residents the NP, PA, or RN takes care of and/or their relative/informal caregiver				
Interview	-	3	• Individual professional factors • Patient factors	Grade
Resident-family council				
Focus group interview	-	All mechanisms	All context factors	Quality of healthcare
Documents				
• Mission and vision of the organization; • Mission and vision of the organization on physician substitution; • Job description of the NP, PA, or RN; • Working arrangements for the NP, PA, or RN and the ECP; • Treatment protocols for the NP, PA, or RN; • Annual report of the organization of the preceding year; • Information about the NP, PA, or RN for residents and family.				

ECP = elderly care physician, NP = nurse practitioner, PA = physician assistant, RN = registered nurse

RESULTS

Three NPs, two PAs, and two RNs were included as cases. Two were male and five female and mean age was 45 years (range, 31–58 years). The nursing homes were scattered across the Netherlands. For the exact number of participants per case, see Table 2.

Table 2 Number of participants per case

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Professional	NP	PA	NP	NP	RN	RN	PA
Managing director/Manager/supervisor	2	1	2	1	2	2	1
ECP	3	2	2	1	4	1 ECP 2 medical doctors	2
Nurse	3	2	1	2	3	1	2
Healthcare assistant	1	2	4	2	2	3	3
Nursing team leader	1	1	-	1	-	1	-
Resident	-	1	5	-	5	-	2
Relative/informal caregiver	7	5	2	5	1	5	3
Member resident-family council	2	2	2	15	7	3	6

ECP = elderly care physician, NP = nurse practitioner, PA = physician assistant, RN = registered nurse

Models of substitution

In the seven cases, substitution of ECPs by NPs, PAs, and RNs was modelled in various ways (see Table 3). The professionals worked in three types of units: (1) unit for residents with physical disabilities, (2) dementia special care unit, and (3) geriatric rehabilitation unit. In most cases the main reason to employ NPs, PAs, or RNs was the shortage of ECPs. The NPs, PAs, and RNs were working with one to four ECPs. Some professionals worked fully autonomously while others worked under the supervision of an ECP. Most worked as a generalist, while some (also) worked as a specialist in, for instance, wound care or care for residents with diabetes mellitus.

Mechanisms of substitution

Below we describe whether any of the three pre-defined mechanisms of ECP substitution (see study-protocol and Figure 1) were present in the cases, and, if so, in which context and with what outcomes.

Mechanism 1

Based on their education and previous experience, NPs, PAs, and RNs are able to substitute for ECPs largely autonomously.

Table 3 Organization of physician substitution in nursing homes

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Professional	NP	PA	NP	NP	RN	RN	PA
Working experience in current professional role	22 months	55 months	50 months	26 months	72 months	25 months	74 months
Type of unit	Dementia special care unit (n = 1)	Geriatric rehabilitation unit (n = 1)	Geriatric rehabilitation unit (n = 1)	Dementia special care unit (n = 2)	Unit for residents with physical disabilities and dementia special care unit (n = 4)	Dementia special care unit (n = 8)	Unit for residents with physical disabilities and dementia special care unit (n = 3)
Reason to employ provider	Among others the shortage of ECPs	Among others the shortage of ECPs	Among others the shortage of ECPs	To enhance continuity and quality and retain costs	To reduce the workload of the ECPs	De-medicalization	Among others the shortage of ECPs
Vision on substitution	-	-	If possible; tasks should be performed by a professional of lower level	NPs are autonomous medical providers	-	The employment of RNs corresponds with the vision of de-medicalization	-
Number of collaborating doctor(s)	1 ECP	1 ECP	1 ECP	1 ECP	4 ECPs	2 medical doctors	2 ECPs
Type of collaboration with doctor(s)	Shared responsibility ECP does not work at another unit	ECP supports the PA ECP works at another unit	Shared responsibility ECP works at other units	ECP supports the PA ECP works at another unit	Shared responsibility ECPs work at other unit(s) except for one	Shared responsibility Medical doctors work at other units	ECPs support the PA ECPs work at other units
Structural and/or ad hoc meetings with doctor(s)	Often ad hoc	Structural and minimal ad hoc	Structural and often ad hoc	Structural and often ad hoc	Dependent on the ECP: minimal to often ad hoc meetings	Often ad hoc	Structural and minimal ad hoc

Level of autonomy	The ECP checks and/or approves the acts of the NP The NP provides wound care autonomous	Fully autonomous	Mostly autonomous Together with the ECP: complex situations, general rounds and multidisciplinary meetings	Fully autonomous	Medical domain: The ECPs check the acts of the RN afterwards or the RN works under supervision Nursing domain: Autonomous	Medical domain: under supervision Nursing domain: autonomous	Fully autonomous
Number of residents	102	12	20	60	199	56	68
Tasks	• Admissions • General rounds • Acute visits • Family meetings • Multidisciplinary meetings • Referral to other disciplines • Wound care	• Admissions • General rounds • Acute visits • Family meetings • Multidisciplinary meetings • Discharge • Referral to other disciplines	• Admissions • General rounds • Acute visits • Family meetings • Multidisciplinary meetings • Discharge • Referral to other disciplines • Specialist on neurological rehabilitation on organizational level	• Admissions • General rounds • Acute visits • Family meetings • Multidisciplinary meetings • Referral to other disciplines	• Admission (in addition to admission by ECP) • General rounds (in addition to round by ECP) • Acute visits • Referral to other disciplines • Care for residents with DM	• Triage • Wound care • Cardio vascular risk management • Care for residents with DM and COPD • Family meetings • Multidisciplinary meetings	• dmissions • General rounds • Acute visits • Family meetings • Multidisciplinary meetings • Referral to other disciplines • Out of hours care • Specialist in acute care on organizational level
Prescribing medication[1]	Yes under supervision of the ECP	Yes autonomous	Yes autonomous if competent	Yes autonomous ECP receives an email	Making proposals to the ECP In exceptional situations checked by the ECP afterwards or under supervision of an ECP	Making proposals to the medical doctors	Yes autonomous

Table 3 *continued*

Official documents within the organization	• Collaborative agreement	• Job description • Collaborative agreement • Prescribing agreement	• Job description • Collaborative agreement • Prescribing agreement • Formation NP/ ECP calculator	• Job description • Prescribing agreement Vision document: roles and responsibilities NP	• Job description • Framework medical team • Framework diabetes care	• Job description • Flow chart support questions	• Job description • Prescribing agreement
Peers in the organization	2 NPs	None	3 NPs	4 NPs	4 RNs	17 RNs	1 PA
Member of which team	Medical	Medical	Medical	Medical	Medical	Nursing	Medical

COPD = chronic obstructive pulmonary disease, DM = diabetes mellitus, ECP = elderly care physician, NP = nurse practitioner, PA =physician assistant, RN = registered nurse

[1] Prescribing medication is one of the so-called 'reserved procedures' described in the Individual Health Care Professions Act that is mostly performed in nursing homes. In the Netherlands, NPs and PAs are authorized to indicate and perform some of the so-called 'reserved procedures', which were initially only reserved for physicians.

Prescribing medication is one of the so-called 'reserved procedures' described in the Individual Health Care Professions Act that is mostly performed in nursing homes. In the Netherlands, NPs and PAs are authorized to indicate and perform some of the so-called 'reserved procedures', which were initially only reserved for physicians. This mechanism of substituting for ECPs largely autonomously was present in four cases (2, 3, 4, 7). In two cases the professional was a PA and in the other two an NP. Two PAs and one NP (cases 2, 4, 7) worked on their own unit(s) with an ECP in the background to discuss residents' care if required. The ECP was seen as an expert colleague, not as a supervisor. In case 3, the NP and the ECP shared responsibility for residents on a certain unit and worked closely together.

Contextual factors that made substitution flourish were organizational factors such as 'organizational leaders, like managing directors, managers, supervisors, and (head) ECPs, that acknowledge NPs or PAs as independent professionals', and individual factors, such as 'the professional having a proactive personality'. Management and the ECPs in these four cases supported the NP or PA to work independently in accordance with their educational background and standards set through legislation. The NPs and PAs in the four cases showed traits that contributed to their work as independent professional since they were proactive, decisive, and communicative, and furthermore had working experience in complex or acute care settings.

"We have structural meetings with all NPs and (name manger), where we discuss things like positioning, development, education, supervision of colleague, i.e. our role in the organization." (NP – case 4)

*"(name PA) is not reactive, but proactive so to say, so (s)he shows what (s)he has to offer and that has made that (s)he has the current role. If (s)he would have been more reactive then it would have been different, I think" (*ECP with whom the PA collaborates most intensely – case 2)

The outcome "saving of time for the ECP" was estimated by the ECPs, NPs, and PAs in case 2, 3, 4 and 7 to be in a range of 60 to 100%. The ECPs, care teams, NPs, and PAs perceived that quality of healthcare outcomes for care provided by the NPs and PAs was as good as that provided by the ECPs concerning effectiveness, efficiency, resident safety, accessibility, timeliness, and patient-centeredness. A few participants stated that some healthcare outcomes were not at the same level as those when the ECPs provided care, for example, efficiency (PA takes more time for resident visits), and timeliness (NP needs more time for clinical reasoning). However, some participants stated that some outcomes were better, for example, effectiveness (PA is more focused on resident's satisfaction), and safety (NP is more focused on getting the details right). All participants in cases 2, 3, 4, and

7 would recommend the way in which substitution of the ECP by the NP or PA is organized in their facility to others. Residents and relatives/informal caregivers graded the care of the NPs and PAs from 6 to 9 on a scale from 1 to 10.

Interviewer: *"Would you recommend the way in which substitution of the ECP by the NP is organized in their facility to other facilities?"*
Manager involved in physician substitution and supervisor/manager of the NP – case 4: "*Absolutely. Because of their different perspective on care and medical treatment, their impact on costs and continuity and their critical view in general.*

The mechanism of substituting for ECPs largely autonomously was not present in three cases (1, 5, 6). In two cases the professional was an RN and in one an NP.

In case 6 the RN worked together with MDs who were not trained as ECPs. The organizational factor that influenced the role of the RN was the organizational vision on quality of elderly care. The nursing home aimed at demedicalization to improve the quality of life of residents. Although the RN did not work autonomously and the estimated outcome of "saving of time for the MD" was relatively low (< 50%), quality of healthcare outcomes were mostly perceived to be as good as care provided by the MDs, and all participants would recommend their model to other organizations because of the added value (see Mechanism 3).

In case 5 the organizational contextual factors identified as hindering optimal substitution were that there was no unambiguous vision for the role of RNs, the RN worked at different locations with different ECPs who all had different expectations for the RN, and the RN took care of numerous residents. The individual contextual factors were that the RN was less organized and a bit reactive. In this context the RN worked quite autonomously occasionally, but the estimated outcome of "saving of time for the ECPs" was relatively low (≤ 50%), quality of healthcare outcomes were not always perceived to be as good as care provided by the ECPs, and not all participants would recommend this model to other organizations.

Interviewer: *"are you making optimal use of the knowledge, skills and competencies of (name RN)?"*
Nurse – case 5: "*No, I don't think so. The RN works too few hours (at this location).*"

The NP in case 1 worked under the supervision of the ECP, instead of autonomously taking care of patients. The position of the NP was more comparable to both RN cases, and on that point distinctive compared to the NPs in cases 3 and 4. Several organizational and individual contextual factors were identified that influenced this case. The management

did not fully recognize the autonomy of the NP, the NP was very precise and sought confirmation, and the ECP found it hard to share responsibility for resident care. The outcomes were that quality of healthcare outcomes were mostly perceived to be as good as care provided by the ECP, but not all participants would recommend their model to other organizations, primarily because the estimated time savings for the ECP were relatively low (≤ 50%).

*"The NP is very detailed and that helps me to understand the problem, but she also risks loosing herself in details." (*ECP with whom the NP collaborates most intensely – case 1)

Residents and relatives/informal caregivers graded the care of these three professionals (cases 1, 5, 6) from 7 to 10 on a scale from 1 to 10.

Interviewer: *"How would you grade the care you receive from the NP, PA, or RN?"*
Resident – case 5: *"Well, an eight"*
…
Resident – case 5: *"Because I think it is just fine, she listens and she is very normal, no attitude."*

Mechanism 2
To describe the different results of the seven cases in mechanism 2 we have divided this mechanism into two mechanisms.

2a. Physician substitution is always a collaboration between the NP, PA, or RN and the ECP.
In cases 3, 4, and 7 the collaboration between the NP or PA and the ECP was based on trust. In these collaborations the ECP shared responsibilities with the NP or PA and the NP or PA took over almost all medical tasks of the ECP. In these cases structural and ad hoc meetings occurred between the NP or PA and the ECP and specific time was allocated for reflection on the collaboration between the NP or PA and the ECP. The organizational contextual factors of these successful collaborations were: 'the NP or PA collaborates (mostly) with only one ECP' and 'organizational leaders that support the NP or PA'. In addition, the following individual contextual factor contributed to this mechanism; 'the NP or PA and the ECP share the same views on what constitutes good resident care'. The quality of healthcare was perceived as good, as described under Mechanism 1.

"(name ECP) is a very good colleague with a lot of knowledge. He is calm, has a listening ear, always has time, always willing to meet … (name ECP) is practical minded and I also do not use too many words… I do not need to give reasons for what is going on. It is either clear or it is not." (PA – case 7)

In cases 1, 2, 5, and 6 collaborations were not well balanced for different reasons. In case 1 the collaboration was very close and not fully based on trust. The ECP did not share responsibilities and the NP took over only some of the ECP's tasks. Individual contextual factors of this intense collaboration included that both the NP and the ECP were perfectionists and sought confirmation, they often wanted to discuss their actions and thoughts while their collaboration was in its early stages. This collaboration was further influenced the presence of conservative organizational leaders regarding the function of the NP. In case 2 the PA and ECP were searching for good collaboration and for the right division of (additional) tasks. The PA worked mostly alone and did not regularly communicate with the ECP. The context for this non optimal collaboration involved the different personalities of the PA (proactivity) and the ECP (reflective), and the fact that the managing director/supervisor gave the PA much freedom to fill in the PA role. Finally, in case 5 and slightly in case 6 there was unstable and ineffective collaboration between the RN and the ECPs or MDs with only ad hoc contact and with ECPs or MDs at a higher hierarchical level. Trust, sharing responsibilities, and taking over tasks could not occur in a context in which the RN worked with several ECPs or MDs who all had different visions of their roles. Nonetheless, the perceived quality of healthcare was guaranteed in most of these cases (1, 2, 6). In cases 2 and 6, in contrast to case 1 and 5, all participants would recommend their model to other organizations.

2b. The role of the ECP changes due to the collaboration with the NP, PA, or RN.
In all cases this mechanism was present, but different forms were observed. In cases 5 and 6 the ECPs and MDs performed less tasks at the border between the medical and the nursing domain, for example, wound care, due to their collaboration with the RN. In case 6, for instance, the RN performed triage and it was stated that the RN could handle 70% of the MD's former consultations. Therefore, the ECPs and the MDs in case 5 and 6 (as well as the ECP in case 1) could focus solely on medical tasks, such as medical diagnosis. In cases 2, 3, 4, 7, and slightly in case 1, ECPs gained time to, for example: fully support general practitioners in the care of older people living at home; chair a multidisciplinary meeting with primary care professionals regarding complex older resident cases; and/or perform (more) tasks such as being a member of internal working groups (e.g., on misunderstood behavior); being a member of the local board of the Dutch association of ECPs; or train medical residents. The individual contextual factor that influenced this mechanism positively was the type of professional: RNs reduced the nursing tasks for ECPs while NPs and PAs also decreased the medical tasks of ECPs. The effect of this mechanism is unknown, but it is expected that when ECPs perform tasks that they formerly did not have time for, it will contribute to the quality of healthcare.

"If the ECPs and the NPs are doing it (their collaboration) right, as it is meant to be, then the NP also brings along a lot of information, through which the ECP can work more efficiently." (supervisor/manager of the NP – case 3)

Mechanism 3

NPs, PAs and RNs have a different way of working and they perform additional tasks compared to ECPs.

In all cases the three types of professionals performed tasks such as: the structural evaluation of restraints, writing care programs, enhancing rehabilitation climate by implementing a breakfast/lunch buffet, educating the care team, being a member of working groups who discussed specific themes and innovations (e.g., on fall prevention). In all cases the management supported the professional to perform these tasks. It was stated that the performance of these tasks contributed indirectly to the quality of healthcare. Continuity of care was increased because NPs, PAs and RNs change jobs less often than MDs who also perform medical tasks autonomously in nursing homes. In cases 1, 3, 4, 5, and 6 the NPs and RNs strengthened the care team by being accessible, being more present at the unit, providing training on the job, and by encouraging self-reflection. In cases 5 and 6 the RNs were closely related to residents and their family because they interacted more often than the ECPs. Type of professional was the individual contextual factor that influenced this mechanism: RNs improved communication with both the care team and resident and family, whereas NPs only improved communication within the care team. In case 4 the NP also contributed to the quality of management and the medical team by adopting a critical attitude.

"There is a difference (between MDs and me in contact with residents and family). It is not necessarily better or worse, but it is different. I think that I am more approachable. Although I have to ensure that I am not too approachable. For the doctor it is the other way around, he has professional contact, but has to ensure that the threshold to contact him is not too high." (RN – case 6)

Elements that contribute to an optimal model of substitution of ECPs by NPs, PAs, and RNs.

Based on the answers to research questions 1 and 2, an optimal model of substitution of ECPs seems to be a model in which the professional substitutes for the ECP largely autonomously, a well-balanced collaboration occurs with the ECP, and quality of healthcare is maintained. This was seen in cases 3, 4, and 7, in which care was substituted by NPs and a PA. Elements that enabled professionals to work according to this optimal model were: (a) being responsible for your own unit; (b) being a PA or NP; (c) being proactive, decisive, and communicative; (d) having working experience in complex and/or acute care settings; (e) being supported by management and ECP(s) to work as independent professional; (f)

collaborating with only one ECP; (g) collaborating with the ECP based on trust; (h) sharing the same views with the ECP on good resident care; (i) time allocated for reflection on collaboration; and (j) structural and ad hoc meetings with the ECP.

DISCUSSION

In this case study we found that substitution of ECPs by NPs, Pas, and RNs is modelled in various ways. There does not seem to be one single best model, but we were able to identify some elements that contribute to optimal implementation of NPs and PAs as substitutes for ECPs in nursing homes. Our description of three mechanisms of substitution showed that according to participants, the NPs and PAs are able to deliver similar quality of healthcare as the ECPs, based on the condition that the collaboration between the NP or PAs and the ECP is qualified as successful. A successful collaboration decreased the medical tasks of the ECPs and contributed to more time for additional tasks, such as a multidisciplinary meeting with primary care professionals. However, the RNs did not substitute for the ECPs autonomously in the medical domain with maintenance of quality of healthcare. In one case the tasks of the RN were mainly delegated, and the RN performed medical tasks under supervision. In this case quality of healthcare was maintained. In another case the RN worked autonomously in the medical domain occasionally; however, the estimated outcome of "saving of time" for the MDs was relatively low and quality of healthcare was not always perceived to be guaranteed by some participants. Nonetheless, in these cases the ECPs and MDs performed fewer tasks on the border between the medical and the nursing domain, for example wound care, due to their collaboration with a RN. In addition, the results showed that NPs, PAs, and RNs may all contribute to perceived quality of healthcare in their own unique way. The mechanisms of physician substitution were mainly influenced by organizational factors such as support of the management, and individual factors, such as type of professional and personality of the NP, PA or RN.

Collaboration based on trust between the ECP and the NP or PA was the key element of successful substitution of ECPs. Below we explain this paradox of substitution (replacement) and collaboration. In our refined theory based on Figure 1, we found that individual factors (*Context*) and organizational factors (*Context*) influenced the interaction and collaboration between the NP or PA and the ECP (*Mechanism*). The mechanism of collaboration influenced in turn the tasks and responsibilities of the NP or PA and the ECP (*Mechanism*), which finally influenced the perceived quality of healthcare (*Outcome*) (see Figure 1). The results further showed that documents related to substitution, such as a job description or collaborative agreements, appeared not to be a goal in itself, but rather a way to support collaboration and substitution between the ECP and the NP or PA. This result is supported by other studies in which trust between the ECP and the NP or PA appeared to be the key in collaboration (22, 23). Based on a concept analysis,

Bridges (2016) defined collaboration between a physician and an NP as "an interaction in which both individuals work as a team in a collegial relationship in an environment where there is mutual trust and respect and open communication ..." p.408 (22). As in our study, the concept analysis of Bridges (2016) revealed that collaboration is influenced by individual and contextual factors. Individual factors that facilitate the collaboration are, for example, self-confidence, having a proactive personality, recognizing your limits, and willingness to cooperate (22). In addition, ECPs and NPs or PAs might have different ideas about collaboration, for example, hierarchal versus autonomous, or different views on good resident care, which might hinder effective collaboration (22, 24). One contextual organizational facilitating factor is, for example, organizational leaders who support collaborative practice by promoting a shared vision (22). These factors correspond with our results. Knowing the contextual factors that influence physician substitution enables stakeholders, like professionals, managing directors, managers, supervisors and educators to anticipate on these factors. For example, educators may support NPs, PAs and RNs in developing their leadership competences and organizations may taken into account NPs', Pas' and RNs' proactivity and communication skills during selection procedures.

The results of the present study are consistent with other studies that showed that the employment of NPs, PAs, and RNs in nursing homes might contribute to perceived quality of healthcare for different reasons. The first reason that applied to two NP cases and two PA cases is that ECPs are enabled to focus on more complex medical activities for which they are trained, such as treating residents with complex healthcare problems and providing high-quality geriatric treatment for older people in primary care (6). The second reason is that NPs, PAs, and RNs have a different way of working, such as focusing on resident centeredness (seen in two RN cases), supporting the care team (seen in three NP cases and 2 RN cases), and performing additional tasks compared to ECPs (seen in all NP, PA and RN cases). The manner in which each type of professional contributes to perceived quality of healthcare corresponds to their education and competences (13, 25, 26). In accordance with our findings, a recent study in the United States also showed that advanced practice nurses can positively influence quality of healthcare in nursing homes by coaching the care team, proactively managing changes in health status, and providing evidence-based care (27).

To further understand how physician substitution in nursing homes may contribute to quality of healthcare we used a realist evaluation approach (16, 18). This theory-driven evaluation matched our research questions perfectly as it gives insight into how mechanisms work and contribute to positive outcomes. Strengths of this approach are the extensive observations and interviews with the stakeholders in each case. This led to a high level of detail and ultimately to a deeper understanding of the processes concerning substitution and collaboration.

There are some methodological points that should be considered while interpreting the results and in further research on this topic. First, this case study built on a theory, which we based on literature and a focus group study (19). This theory-driven approach helped us to explore the complexity of substitution of care in a systematic way. However, although theory-driven, as researchers we also kept an open mind while collecting and analyzing data in this study with certain propositions, which enabled us to identify new mechanisms when results acquired this (17). In comparison with other realist evaluations (28, 29) we did not identify unanticipated new mechanisms, but we did refine our initial theory. Second, only seven cases were included in this study which affected the generalization. However, in realist evaluation, generalization means progressively applying the theory to other settings (18). Particularly the maximum variation of sampling in our case study contributed to insight into the head mechanisms in different contexts. The theoretical explanations, which mechanism works in which context, developed in this study are open to further development and refinement. Third, although we cannot rule out selection bias due to voluntary participation, the fact that participants also pointed out barriers and were not all unanimously positive leads us to believe that the influence of selection is relative low. Fourth, the outcomes in this study were self-reported and qualitative and for some (e.g., time saving) we estimated outcomes; we were not able to confirm these data with other more objective sources such as timesheets or performance indicators. Although the experiences of all parties involved are very valuable it would be interesting to combine these outcomes with quantitative outcomes in the future (30). Last, the interview guides were based on three key elements: mechanisms, contexts, and outcomes. Every key element was explored separately, as the relationships among them were unknown, and in the analysis connections were made (27). For further research it would be interesting to use an interview guide based on the mechanisms with the accompanying contexts and outcomes found in this study to further understand the relationships among them (31).

CONCLUSION

In this study we present a refined theory of substitution of ECPs by NPs, PAs, or RNs, which shows how context, mechanism, and outcomes relate to each other. The main conclusion is that although one best model did not emerge, NPs and PAs seem to be able to largely autonomously substitute for ECPs, with at least maintenance of perceived quality of healthcare in case of a successful collaboration. RNs seem to be able to lower ECPs' tasks at the border between the medical and the nursing domain. Whether the employment of an NP or PA leads to successful collaboration and thus successful substitution depends mostly on whether the collaboration between the NP or PA and the ECP is based on trust. Organizational factors (e.g. an organizational leaders that support the NP or PA)

and individual factors (e.g. the NP or PA being proactive, decisive, and communicative) influence the collaboration and therefore the level of substitution. NPs, PAs, and RNs in nursing homes may all be valuable in their own unique way, matching their profession, education, and competences. This information can be used to create an optimal collaboration between different types of professionals in nursing homes. It can also contribute to further research in particular in the theory development of substitution of care.

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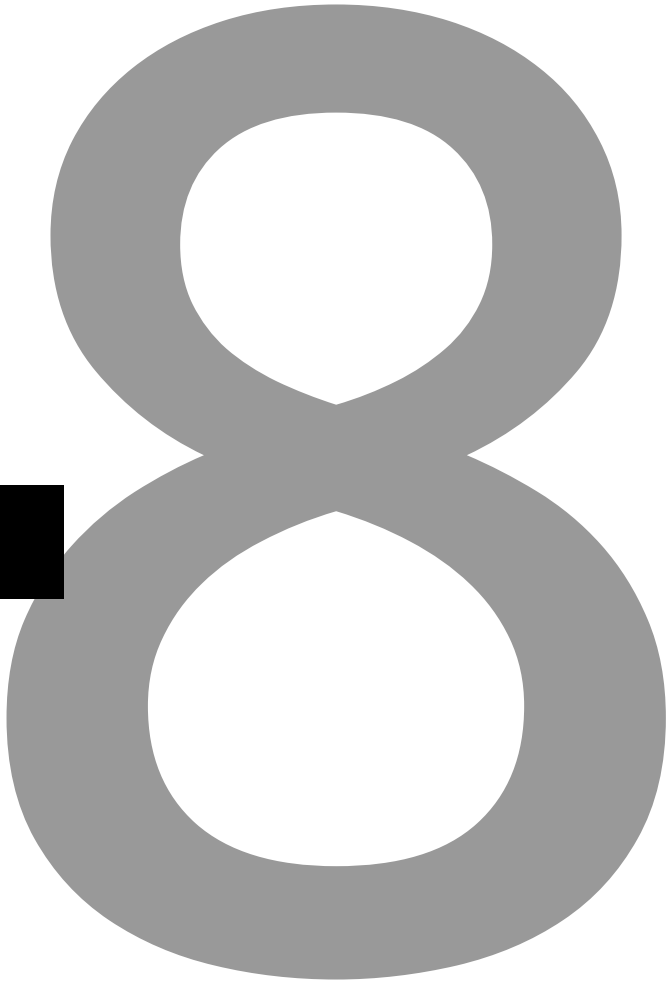
CHAPTER 8



General discussion

The aim of this thesis was to provide insight into the impact of substituting physicians with nurse practitioners (NPs), physician assistants (PAs) or registered nurses (RNs)[1] in healthcare for older people and to provide insight into how this can be organized. Several consecutive studies were conducted: a systematic literature review, two qualitative (focus group) interview studies, and a multiple-case study.

In this final chapter the main findings of these studies will be presented, discussed and interpreted in the light of relevant literature. Subsequently, the methodological considerations are discussed. Finally, implications and recommendations for practice and policy, education and future research are given.

Main findings

The main findings are based on all studies presented in this thesis and are displayed according to 1) impact of substitution, and 2) organization of substitution. Substitution for physicians means: expanding the breadth of a job by providing the same services as the physician, while the new provider is responsible/autonomous.

Impact of substitution

- International studies showed that care provided by NPs, PAs or RNs as substitution for physicians in primary healthcare for older people and in nursing homes appeared to achieve patient outcomes and process of care outcomes which are at least as good as care provided by physicians. Evidence about resource use was ambiguous and evidence with regard to costs was too limited to draw conclusions (chapter 3).

- According to healthcare professionals in the Netherlands, NPs, PAs and RNs were considered to have an added value in healthcare for older people and in nursing homes, as they contributed to quality of healthcare, provided person centered care, and strengthened the care teams (chapter 4, 5 and 7).

- In the Netherlands, the role of the general practitioner (GP) and the elderly care physician (ECP) changed with the introduction of NPs, PAs and RNs into a more coordinating role (chapter 4, 5 and 7).

- In the Netherlands, NPs and PAs in nursing homes appeared to be able to substitute for ECPs largely autonomously while maintaining quality of healthcare (chapter 7).

1 The RNs included in this thesis were: practice nurses, district nurses, geriatric nurses and nurses with a specialty in gerontology and geriatrics

Organization of substitution

- International studies showed that to successfully implement NPs, PAs or RNs as physician substitutes in healthcare for older people several conditions on different levels should be met:
    - At a societal level, there should be appropriate funding, there should be enough NPs, PAs or RNs available, legislation should enable physician substitution, and the curricula of NPs, PAs and RNs should include geriatric care.
    - The organizational climate should support NPs, PAs and RNs in expanding their role.
    - NPs, PAs and RNs should have a pioneering spirit and the physicians should be willing to share responsibility for patient care (chapter 3).

- In primary healthcare in the Netherlands, NPs, PAs and RNs take care of a range of different patient populations. Only a small part of their job focuses on older people living at home. PAs are employed at the general practice, whereas NPs and RNs are employed at community nursing services as well (chapter 4).

- In the Netherlands, the roles and responsibilities of NPs, PAs and RNs in primary healthcare for older people differ between, as well as within professions (chapter 4).

- In the Netherlands, a clear vision on primary healthcare for older people, including the organization of proactive healthcare, and the role of each professional is lacking (chapter 4).

- In the Netherlands, skill mix change in primary healthcare for older people is also influenced by a lack of team performance, a lack of collaboration, trust and acceptance of each other's expertise among NPs, PAs, RNs and GPs, and unfamiliarity of older people with NPs, PAs and RNs (chapter 4).

- In nursing homes in the Netherlands, skill mix change is organized in various ways. NPs, PAs and RNs all work at unit level, although some also work at the organizational level with a special area of expertise (chapter 5).

- In nursing homes in the Netherlands, PAs take over a broad range of (complex) tasks from ECPs. Among the NPs there is a range of responsibilities, from only performing tasks according to protocols to performing more complex tasks. The RNs prepare work for ECPs and support them in (medical) care. There is variation in how NPs, PAs or RNs collaborate with ECPs (chapter 5).

- In the Netherlands, different factors contribute to the variation in skill mix change in nursing homes: lack of a vision on skill mix change, lack of acceptance of NPs, PAs, and RNs by other providers and older people, and personal factors of the providers involved (chapter 5).

- In the Netherlands, elements that enable NPs and PAs in nursing homes to work to their full scope of practice as physician substitutes are: (a) being responsible for their own unit; (b) being proactive, decisive, and communicative; (c) having working experience in complex and/or acute care settings; (d) being empowered by management and ECP(s) to work as independent provider; (e) collaborating with only one ECP; (f) collaborating with the ECP based on trust; (g) sharing the same views with the ECP on good patient care; (h) time allocated for reflection on collaboration; and (i) structural and ad hoc meetings with the ECP (chapter 7).

- In general, in the Netherlands the discussions about skill mix change are hindered by the confusion about the meaning and goals of substitution, supplementation, delegation and the legal consequences of substituting responsibilities (chapter 4, 5, 7).

Discussion of the main findings

Impact of substitution

The impact of substitution of NPs, PAs and RNs for physicians in healthcare for older people shown in our studies, is in line with the impact in other settings, e.g. hospital care and primary healthcare. Studies indicate that substitution of care leads to equal or better patient outcomes. In addition, it may lead to equal or better process of care outcomes, while the evidence regarding costs is limited and heterogeneous (1-5).

Research presented in this thesis showed that better patient and process of care outcomes can be the result of NPs, PAs, or RNs who perform tasks differently from physicians. Furthermore, NPs, PAs, or RNs were perceived to have an added value as they have the opportunity to provide additional services which complement or extend those provided by the physician, which is referred to as supplementation. There are several other studies that endorse the added value of NPs and RNs in healthcare for older people. NPs, for example, better contribute to maintenance of patients' quality of life (5), improve quality measure scores by focusing on quality improvement strategies (6), reduce hospital admissions by delivering continuity of care (7), improve outcomes for patients with diabetes mellitus by implementing a diabetes care program (8), and improve staff confidence by providing training on the job (9). NPs might also be of added value due to their professional attitude,

including being empathic, having good patient communication skills and by providing support and guidance to older people (10-12). However, in contrast to the results of our focus groups study and other studies (chapter 5), our case study (chapter 7) did not show that NPs enriched communication with residents and family. It may be that the NPs mainly performed a substitute role and did not integrate their nursing background in their work/role. On the other hand, it may be that ECPs apply a holistic approach in patient contact that does not differ from the approach of NPs (13). RNs are stated to improve healthcare by coaching the care team and creating a person centered culture (14-16). Remarkably, we found no other studies that support the added value of PAs in healthcare for older people found in our studies (17). Next, although RNs and NPs frequently performed proactive healthcare interventions, such as comprehensive geriatric assessments, preventive home visits and/or case management, there is no unambiguous evidence that supports the impact of these interventions (18-26).

The change in the role of GPs and ECPs to a more coordinating role (chapter 4, 5 and 7) was sometimes perceived as a negative effect by GPs and ECPs. They stated to have less direct patient contact and less freedom because they are required to be available to support the NP, PA or RN, and mainly had consultations for complex patients, which increases the caseload. It might be that the perceived negative effects are a result of more traditional and hierarchical education of the GP or ECP or resistance regarding transferring medical task as it involves giving up an exclusive claim to these tasks (27). As a positive effect, one might say that by the introduction of NPs, PAs and RNs, GPs and ECPs are able to perform more medical activities at the level they are trained for (13, 28).

Organization of substitution

In this thesis we found several reasons why skill mix change in healthcare for older people is not organized optimally yet. Two possible reasons for the suboptimal organization are the type of care that is provided and the number of NP, PA or RN peers. With regard to the type of care, a difference between hospital care and care provided to older people in primary healthcare or nursing homes is that care in hospitals is more delineated. Therefore, it may be easier to shift tasks from one provider to another. Healthcare for older people is complex as it demands knowledge of all healthcare specialties and it also involves care for which no suitable guidelines or protocols exist. Because of this complexity, physicians may be reluctant to shift tasks to a lower grade provider, as shown in chapter 4, 5 and 7. In addition, nursing homes and primary healthcare mostly have a low number of NPs, PAs or RNs, while in hospitals the numbers of these professions are larger, which results in more peer support. The fact that NPs, PAs and RNs in healthcare for older people often work as soloists may hinder their role development.

Specific for the primary healthcare setting the lack of vision on care for older people hinders the organization of healthcare and specifically the organization of skill mix change (29). Many older people wish and do grow old in their own home (30, 31). To support them, the World Health Organization states that it is important to provide person centered and integrated care (32). This means that the focus of care is more on the needs, preferences and life story of the older people than on the healthcare problem. The care providers support the older person in living a good life as best he/she can, according to his/her own standards (33). The professional association of Dutch GPs has plead for proactive, person centered and coherent care in their 'Vision general practice care for older people' (34). In order to improve collaboration among different care providers two documents have been published: 1) a collaborative agreement for among others GPs, practice nurses and district nurses (35), and 2) a guidance for collaboration between GPs and ECPs (36). However, there appears to be uncertainty about how proactive person centered care should be provided and what its effectiveness is (18-26). As long as this uncertainty exists it is difficult to discern the role of each professional in primary healthcare for older people and to determine the optimal skill mix.

The development of a vision on good quality of care appeared to be a step further in nursing homes than in primary healthcare. Lately, a lack of quality of healthcare in nursing homes has received a lot of (media) attention, for example, by the publication of the 'black list' of poorly performing nursing homes by the Health and Youth Care Inspectorate and by the foundation of the manifest 'being sharp in healthcare for older people' (37, 38). In order to improve quality of healthcare, the Ministry of Health, Welfare and Sport launched the program 'Dignity and pride', the National Health Care Institute published the 'Quality framework nursing home care', and more recently the additional report 'At home in the nursing home' (39-41). This program and these reports provide a vision on good quality of nursing home care and tools how to achieve this. They state that quality of healthcare comprises a focus on person centered care and support; living and well-being; safety; and learning and improving (40). To translate this vision on quality of care into daily practice standards have been developed to come to adequate skill mix in nursing teams to provide quality care (40). In 2019, the field provided different tools to support care providers, managers and policy makers to apply these standards to their local context (42). In addition, our research showed the need for translating the vision on quality of healthcare to a vision on roles, tasks, and responsibilities, not only for the nursing teams, but also for NPs, PAs, RNs and ECPs as a clear vision on the skill mix is currently lacking in nursing homes. To date, the professional associations of NPs, PAs and ECPs do not have an unambiguous vision or a joint agreement on how to organize skill mix change in nursing homes.

Another reason for the suboptimal organization of skill mix change is staff shortages. There is a shortage of physicians, RNs, registered vocational trained nurses and nursing assistants in primary healthcare as well as in nursing homes (43, 44). Our research showed that the introduction of NPs, PAs and RNs as substitutes for physicians as an answer to high workload and labor market problems, hinders the focus on the unique contribution to quality of healthcare of each professional in a team. In addition, a shortage of nursing assistants and nurses has the risk that NPs, PAs and RNs fill in this gap and as a result perform a relatively large number of nursing tasks that can also be performed equally well by lower educated professionals.

The results of our research also show that overuse, in RN cases, and underuse, in NP and PA cases of competences existed because of unfamiliarity among the professionals themselves, other professionals, managers and policy makers. They were unfamiliar with job content and qualifications of NPs, PAs and RNs and with the legal frameworks of substituting responsibilities. The boundaries between substitution and delegation, and nursing and medical tasks are not always that clear. This might be due to changes in practice over time, for example taking blood pressure was formerly only reserved to physicians, while nowadays it is a nursing procedure (47).This unfamiliarity hindered the acceptance of NPs, PAs and RNs and their collaboration with physicians and the multidisciplinary team, although it is known that these collaborations are of vital importance in developing an optimal model of skill mix change (45, 46). Our research showed that this unclarity mainly caused confusion regarding the substituting role of RN. Therefore, it is important to not only have general knowledge of the competences of each provider and legal frameworks (e.g. Dutch RNs are only allowed to perform 'reserved procedures' after instructions from a physician (or NP or PA)), but also to discuss and record each other's role, tasks and responsibilities. Yet, nationally and internationally, different models and forms exist to enable discussion and recording of competences and responsibilities (48-55).

At last, we found that older people and their family are also unfamiliar with the function of NPs, PAs and RNs and this may cause a lack of acceptance. A recent Dutch study shows that this problem is not limited to the function of NPs, PAs and RNs. Older people do not know where to go with which question; they experience the organization of care as complicated. It was stated that the communication between care providers, the division of roles and coordination of care should improve (56). To sum up, there appears to be a lack of transparency around the skill mix in healthcare for older people. However, the case study in this thesis (chapter 7) and other studies showed that when patients do know the NP or PA personally, they are mostly very satisfied with the care they receive (3, 57-59).

Methodological reflections

A main strength of the empirical studies in this thesis is the fact that they were conducted close to or even in daily practice. Interviews and observations were an appropriate method to gain in-depth insight into the status of substitution and skill mix change. Especially the realist evaluation approach which was applied in the multi-case study helped to understand the complexity and context of skill mix change as it helped to answer why, how, who and when questions (60). In addition, all care providers involved in skill mix change were included in the qualitative studies. In the multiple-case study also managers and older people and their family were included to get the full picture.

The main researcher of the studies in this thesis had a nursing background. This may have caused researcher bias as she may have collected and analyzed data from a nursing point of view and to a lesser extent from a medical point of view. However, the researcher and the research team were aware of this risk of bias and reflected critically on the data collection and data analyses through all phases of the studies and often a second researcher was involved. In addition, an ECP was part of the research team and added the medical point of view during the discussions about the design and the data analysis of the different studies. The members of the advisory board of the studies reflected from different perspectives (patient, care provider, education, policy) on the findings.

The impact of physician substitution was measured in different ways; quantitatively in the systematic literature study and as perceived outcomes in the qualitative interview studies and the multiple-case study. In the multiple-case study no quantitative outcome data was collected. Although the experience of different stakeholders is very valuable in measuring the impact of complex interventions, other studies have shown the additional value of combining qualitative data with more quantitative data in multiple-case studies (61, 62). At the time of this study, there was a debate in the Netherlands about quality standards for care provided in nursing homes. This debate resulted in a program and reports that provide a vision on good quality of care and tools how to achieve this (39-41). This may lead to more quantitatively formulated outcome measurements (indicators) of skill mix change in nursing homes, such as medication safety and advanced care planning.

Another limitation is the relatively low number of participants form only one country (the Netherlands), including care providers, managers, and older people and family, in our empirical studies. This is related to the fact that mainly qualitative studies were conducted as the best method to gain in-depth insight into this topic. The qualitative studies added to our knowledge on substitution of healthcare for older people. Nonetheless, it may influence the transferability. However, transferability within the Netherlands is justified for several reasons. First, the participants of the qualitative studies worked for different

organizations scattered over the country. Second, the sampling in the multiple-case study was based on maximum variation sampling. Last, the results of all studies were discussed in an advisory board with representatives of all stakeholders. The advisory board confirmed the main findings. Whether the findings are transferable to other countries depends on the way healthcare for the older people is organized in these countries. To facilitate readers' judgments about transferability a clear description of the Dutch context is given in this thesis (chapter 1, 4-7).

The focus of this thesis was on substitution, as NPs, PAs and RNs were introduced in healthcare for older people as substitutes to physicians because of the high workload. It was therefore important to gain insight in the impact and organization of physician substitution. Nevertheless, during this study the national focus changed from substitution to the broader context of skill mix change as described by the Dutch Task Force 'care in the right place' (63).

Implications and recommendations for practice and policy

This thesis showed a need for actions on different levels to optimize the organization of skill mix change at the level of policy makers, the level of professional associations, the level of organizations, the level of care providers, and at the level of older people. Below we will provide important implications that may apply to all levels.

Needs and preferences of older people as starting point for optimal skill mix

In organizing healthcare there should be greater emphasis on the unique contribution to quality of healthcare by each professional in a team. In 2018, the Dutch Task Force 'care in the right place' pleaded for the physical, mental and social functioning of people as starting point in the organization of healthcare (63). This may contribute to more optimal organization of skill mix change in healthcare for older people, because the professional with the right competences will be in the right place. When introducing skill mix change it is important to define the problem, the patient population and the current model of care (care as received by patients) (29). Although the problem can be related to accessibility of care, for example because of a shortage of physicians, the needs and preferences of patients should be the starting point of the solution (63). The next step should be defining goals of skill mix change to improve healthcare and defining competences with accompanying functions that are needed to achieve these goals (29).

In primary healthcare policy makers, professional associations and care providers should discuss the goal of (proactive) healthcare for older people living at home, which provider is most competent in which case, how different providers should collaborate etc. (48-50).

Person centered care appears to be key in good primary healthcare for older people (32, 34). NPs, PAs and RNs are fully capable to provide this as they are, compared to physicians, more educated to focus on the aspects that make life worthwhile (64, 65).

In nursing homes the vision on quality of healthcare should be further translated to a vision on skill mix in their personnel policy. In other words, stakeholders should discuss how each care provider, NP, PA and RN can contribute to quality of nursing home care (29). The before mentioned toolbox that has been developed for adequate skill mix in nursing teams could be extended with tools to come to adequate skill mix in nursing homes including the NP, PA and ECP (42).

To translate this vision on skill mix into practice, standards have been developed to come to adequate skill mix in nursing teams to provide quality care (40). In 2019, the field provided different tools to support care providers, managers and policy makers to apply these standards to their local context (42).

The professional associations of NPs, PAs, RNs, GPs and ECPs should develop a joint agreement on how to organize skill mix change in healthcare for older people. Such a joint agreement should guide organizations and care providers in defining quality of healthcare for older people and organizing the right skill mix to provide quality care. The professional associations of NPs, PAs and ECPs intend to write a joint agreement for nursing homes in 2019. However, the professional association of GPs is not involved in this process. It is advisable that they are also involved to discuss skill mix change in primary healthcare as currently there is discussion about who should provide care to residents in small-scale living facilities (66).

Promote familiarity with functions and legislation

To implement skill mix change in an optimal way, more familiarity with the different functions, their competences, tasks and responsibilities is needed. Everyone involved in skill mix change should know the legal frameworks.

In 2017 disciplinary jurisdiction has taken place about an ECP-NP case(67). This jurisdiction provides information about the legal consequences of substituting responsibilities; the ECP is not responsible in case of substitution. Discussing this jurisdiction in professional journals, within professional associations and in organizations might provide more clarity about the legal framework.

In addition to a joint agreement of the professional associations of NPs, PAs and ECPs about the organization of skill mix change, it would be very helpful if professional profiles were written for NPs and PAs working in healthcare for older people. Such a profile is already

available for practice nurses (68). These profiles could be developed in collaboration between the professional associations of ECPs, NPs and PAs. This may support care providers in defining their role, tasks and responsibilities and in informing older people and family about the function of different providers.

More clarity among policy makers, managers and care providers about the function of NP, PA and RN in healthcare for older people may automatically lead to better understanding of their function among older people and their family. Professionals will be more capable to explain the (unique) contribution of NPs, PAs and RNs in quality of healthcare to older people and their family. However, there will remain a need for more general awareness of NPs, PAs and RNs among older people and their family. This can be reached by (national) campaigns, for example by flyers or commercials. Such information material is already available on the website of 'Platform Zorgmasters'. This platform is supported by the Ministry of Health, Welfare and Sport.

Create embedded functions

It is important that organizations create functions for NPs, PAs and RNs that are attractive and clear. This means that they correspond with legislation and are embedded in the job classification system.

Most NPs, PAs and RNs included in this thesis worked solo or in a small group of NPs, PAs or RNs. It is very helpful for NPs, PAs and RNs when they have the opportunity to discuss their role with peers. This allows them to support each other and exchange experiences on the performance of their role. This collaboration may take place within an organization, but also across organizations.

In addition, the shortage and high turnover-rate in the nursing discipline in primary healthcare and nursing homes stimulates NPs, PAs and RNs to fill this gap by performing nursing tasks which are not part of their role (43, 44, 69). For optimal use of competences, it is therefore important that this shortage is solved. However, recent studies showed that a higher number of nursing staff does not automatically lead to improved quality of healthcare, while a more diverse skill mix can result in improved quality of healthcare (70, 71). A broader focus on the right mix of professions and competences including NPs, PAs and RNs might not only lead to better support of older people it may also make healthcare for older people more attractive to (potential) care providers for two reasons. One, the function of NP, PA or RN can be seen as a career perspective for care providers who wish to develop themselves and may prevent them from withdrawing from healthcare. Second, NPs, PAs and RNs are able to coach and support the nursing discipline in their work, which may enhance their confidence and job satisfaction (41).

The creation of embedded functions in organizations can further be facilitated by discussing this topic with care providers and policy makers who have experience in implementing skill mix change. Organizations can use the 'Guide division of responsibilities in collaboration in healthcare' and the 'Guide implementation of substitution' (72, 73). This thesis also showed the need for a collaborative agreement between the NP, PA or RN and the physician. Individual NPs and PAs can use the 'Work form implementation of substitution nurse practitioner' or 'Work form implementation of substitution physician assistant' (54, 55). For RNs such a form should be developed.

Implications and recommendations for education

To successfully work as physician substitutes and to contribute to the organization of skill mix change, it is important that NPs, PAs and RN have competences in leadership, entrepreneurship and profiling. Leadership should entail clinical leadership and professional leadership. This means professionals should be able to change and improve healthcare in response to client needs and to advance their own profession (74).

This thesis showed that collaboration based on trust between the physician and the NP, PA or RN was a key element of successful skill mix change. To trust each other it is essential to learn about each other's competences and responsibilities. Although evidence is limited, inter-professional education might be a promising tool to teach future providers how to collaborate effectively (75-77). Moreover, special attention for legislation related to skill mix change in this inter-professional education is necessary. In addition, thorough education of NPs, PAs and RNs in geriatrics, gerontology and the organization of healthcare for older people, could enhance their confidence and this may increase physicians' willingness to shift tasks to these professionals. In 2019, the new professional profile for NPs has been published. In this profile there are no longer five subspecialisms, but two: general healthcare and mental healthcare (78). Healthcare for older people is described as an area of expertise of general healthcare. This new profile could inform Universities of Applied Science on how to educate NPs in healthcare for older people. There should also be a focus on NPs or PAs who did not work in healthcare for older people during their education, but switch to this setting during their work life. They may possibly need additional training or support.

Recommendations for future research

For future research we recommend that the focus is on team skill mix, instead of solely on physician substitution, and the effect on person centered care. Ultimately, a team is responsible to provide quality of healthcare to older people and not an individual care provider. Research should do justice to the unique contribution of each care provider to quality of healthcare for older people.

For the organization of skill mix change in primary healthcare for older people it would be very helpful to conduct a multiple-case study similar to our multiple-case in nursing homes. A multiple-case study according to the realist evaluation approach can provide insight in different models of skill mix change including NPs, PAs and RNs (62). This study may provide input for a national Delphi study with different experts, including older people, on how to provide the right primary healthcare to older people by the right professional in the right place (79).

As described earlier we did not include quantitative data in our multiple-case case study in nursing homes. Therefore, it is impossible to draw definitive conclusions regarding outcomes of skill mix change. For 2018, the field of nursing home care has provided tools (indicators) on how to measure quality of person centered care (41, 80), including patient satisfaction, medication safety, and advanced care planning. In a future case study according to realist principles it would be interesting to combine qualitative data with these quantitative data (6). The approach of realist evaluation may help to distinguish the impact of skill mix change, as context factors may influence the outcomes, and not merely the model of skill mix change implemented (81). Insight in the impact of skill mix change on costs and cost-effectiveness in nursing homes will also contribute to more definite conclusions. In the Netherlands, such a study has already taken place in hospitals and showed no higher costs after the introduction of NPs and PAs (82). Although not yet optimal, hospitals make use of the DBC ('Diagnose Behandeling Combinatie') system to register the activities and thus costs of the NPs and PAs as well as costs of medical doctors and medical specialists can be extracted from this administrative system. Different stakeholders (e.g. researcher, nursing home organizations, policy makers) should discuss how to measure costs and calculate cost-effectiveness in relation to skill mix change in nursing homes. It would also be interesting for a future case study to include a case in which no NP, PA or RN is involved in the care provided. This could be usual care by an ECP or medical doctors. This will contribute to more definitive conclusion regarding the impact of introducing NPs, PAs or RNs on quality of nursing home care.

Final conclusion

This thesis shows that NPs and PAs in healthcare for older people are able to substitute GPs or ECPs largely autonomously with at least maintenance of quality of healthcare. RNs are able to prepare work for physicians and to support them. NPs, PAs and RNs all have their own unique added value as they contribute to quality of healthcare, provide person centered care and strengthen the care team.

Substituting physicians with NPs, PA or RNs is a possible solution to the high workload and shortage of physicians in healthcare for older people and it provides opportunities for physicians to fulfill a more coordinating role. They can also fulfill a role as clinical expert for older people with more complex needs. However, a limited focus on substitution does no justice to person centered care and does not contribute to the right care in the right place by the right person. A vision on how to organize person centered healthcare for older people should be the starting point of care and this vision should be translated into the most optimal skill mix. Changes in skill mix by introducing NPs, PAs or RNs can only be successful if stakeholders are familiar with these functions and legislation, and if functions are embedded in the new model of care.

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SUMMARY

Worldwide as well as in the Netherlands, the population is aging. As a result of the aging population and the fact that the chance of developing a chronic disease increases with increasing age, it is expected that the number of older people with a chronic illness and multimorbidity will rise. At the same time many older people wish to grow old in their own home. In the Netherlands, as in other developed countries, governance-reforms are implemented to shift care from hospitals and long-term care facilities to the community. These reforms and the growing number of older people, increases the demand on both primary healthcare and on nursing home care to provide suitable care. However, relatively few medical students are interested in healthcare for older people. To face the challenges that come along with the growing number of older people, reforms and shortage of physicians, nurse practitioners (NPs), physician assistants (PAs) and registered nurses (RNs) were introduced as general practitioners (GPs) and elderly care physicians (ECPs) substitutes. Substitution for physicians means expanding the breadth of a job by providing the same services as the physician, while the new provider is responsible for his own work. The new provider is qualified to work autonomously. In order to enable care providers, managers and policy makers to make informed decisions about substituting physicians with NPs, PAs or RNs in healthcare for older people there is a need for evidence concerning the impact and organization of substitution.

The central aim of this thesis is to provide insight into the impact of substituting physicians with NPs, PAs or RNs in healthcare for older people and how it can be organized.

Chapter 2 presents the study protocol of a systematic literature review that evaluated the effect of physician substitution in primary healthcare for older people and long-term care facilities and described facilitators and barriers to the implementation of physician substitution. The review used Cochrane methods. The following databases were searched from January 1995–August 2015 for original research studies that quantitatively compared care provided by a physician to the same care provided by an NP, PA or nurse: PubMed, EMBASE, CINAHL, PsycINFO, CENTRAL, and Web of Science. Study selection, data extraction, and quality appraisal were conducted independently by two reviewers. Outcomes collected were: patient outcomes, process of care outcomes, care provider outcomes, resource use outcomes, costs and descriptions of the implementation. Data synthesis consisted of a narrative summary.

Chapter 3 describes the results of the systematic literature review. In total, 11,340 records were found of which 12 studies were included. Two studies used a randomized controlled design (RCT) and ten studies used other comparative designs. Year of publication varied from 1997 to 2015. Most studies were conducted in the USA, followed by one study from

Canada, Sweden and Japan. Seven studies took place in long-term care facilities. In five of these studies, the care provider was an NP, in one a PA and in one study both an NP and a PA were deployed. The other five studies were performed in primary healthcare settings. In three of these studies, the care provider was an NP, in one a nurse and in one study both an NP and a PA were deployed. Two of the ten studies using another comparative design had low methodological quality and were excluded from analysis of the effect of substitution. The following outcomes were reported: 1) patient outcomes, such as quality of life mortality and HbA1c; 2) process of care outcomes, such as quality indicators scores and percentage prevention performance; and 3) resource use outcomes, such as medication and number of hospital admissions. None of the included studies reported on care provider outcomes, such as workload and job satisfaction. The evidence of the two RCTs showed no effect on approximately half of the outcomes and a positive effect on the other half of the outcomes. Results of eight other comparative study designs pointed towards the same direction, with the exception that two studies showed an increase in the number of acute unplanned visits in case of substitution. No studies reported on care provider outcomes and evidence about costs was too limited to draw conclusions. The implementation was influenced by factors on a societal, organizational and individual level.

Chapter 4 presents a qualitative study that describes how skill mix change is organized in daily practice, what influences it and what the effects are of introducing NPs, PAs or RNs into primary healthcare for older people. In total, 34 care providers working in primary healthcare in the Netherlands were interviewed: GPs (n=9), NPs (n=10), PAs (n=5) and RNs (n=10). Five focus groups and 14 individual interviews were conducted. Analysis consisted of open coding, creating categories and abstraction. NPs, PAs and RNs took care of a range of different patient populations. Only a small part of their job focused on older people living at home. PAs were employed at the general practice, whereas NPs and RNs were employed at community nursing services as well. The tasks that NPs, PAs and RNs performed and their responsibilities in healthcare for older people differed between, as well as within, professions. A clear vision on primary healthcare for older people, including the organization of proactive healthcare, and the role of each professional appeared to be lacking. Skill mix change was also influenced by a lack of team performance, a lack of collaboration, trust and acceptance of each other's expertise among NPs, PAs, RNs and GPs, and unfamiliarity of older people and family with NPs, PAs and RNs. Nevertheless, interviewees considered NPs, PAs and RNs an added value, and it was stated that the role of the GP changed with the introduction of NPs, PAs or RNs.

Chapter 5 presents a qualitative study that aimed to describe the ways in which skill mix change is organized through introduction of NPs, PAs, or RNs in nursing homes, what factors influence it, and the perceived effects. Four mono-disciplinary focus groups and

one multi-disciplinary focus group were conducted with in total 32 care providers: ECPs (n=9), NPs (n=10), PAs (n=6) and RNs (n=7). Analysis consisted of open coding, creating categories and abstraction. Variation in tasks and responsibilities was found. All NPs, PAs and RNs worked at unit level, although some also work at the organizational level with a special area of expertise. PAs took over a broad range of (complex) tasks from ECPs. Among the NPs there was a range of responsibilities, from only performing tasks according to protocols to performing more complex tasks. The RNs prepared work for ECPs and supported them. There was also variation in how NPs, PAs or RNs collaborated with ECPs. Despite this variation interviewees reported increased quality of healthcare, patient-centeredness, and support for care teams and a more coordinating role for ECPs. Skill mix change in nursing homes appeared to be influenced by a lack of a vision on skill mix change, lack of acceptance of NPs, PAs, and RNs by other providers, older people and family, personal factors of the providers involved, and confusion about the legal consequences of substituting responsibilities.

Chapter 6 presents the study protocol of a multiple-case study that draws upon realist evaluation principles. This study aimed to gain insight into how physician substitution in nursing homes is modeled and whether it contributes to perceived quality of healthcare. Second, this study aimed to provide insight into the elements of physician substitution that contribute to quality of healthcare. In the protocol the initial theory is presented and describes three mechanisms: 1) Based on their education and previous experience, NPs, PAs, and RNs are able to substitute for ECPs largely autonomously; 2a) Physician substitution is always a collaboration between the NP, PA, or RN and the ECP; 2b) The role of the ECP changes due to the collaboration with the NP, PA, or RN; and 3) NPs, PAs and RNs have a different way of working and they perform additional tasks compared to ECPs. In order to refine this theory, seven cases were selected based on maximum variation sampling. The primary participants were NPs, PAs and RNs. ECPs, medical doctors (MDs), managing directors/managers/supervisors, nursing team members, and residents/relatives were included as secondary participants. Data collection consisted of observations, interviews, questionnaires, and analysis of internal policy documents. At completion of each case a single-case analyses was carried out followed by a cross-case analysis at the end of the study.

Chapter 7 describes the results of the multiple-case study. The seven cases comprised three NPs, two PAs and two RNs (i.e. practice nurses). An optimal model of substitution of ECPs seems to be one in which the professional substitutes for the ECP largely autonomously, a well-balanced collaboration occurs between the ECP and the substitute, and quality of healthcare is maintained. This model was seen in two NP cases and one PA case. Elements that enabled NPs and PAs to work according to this optimal model were among others: collaborating with the ECP based on trust; being proactive, decisive,

and communicative; and being empowered by organizational leaders to work as an independent professional. A successful collaboration between the NP or PAs and the ECP decreased the medical tasks of the ECP and contributed to more time for additional tasks, such as a multidisciplinary meeting with primary care professionals. The RNs did not substitute for the ECPs/MDs autonomously in the medical domain with maintenance of quality of healthcare. Nonetheless, in these cases the ECPs/MDs performed fewer tasks on the border between the medical and the nursing domain, for example wound care, due to their collaboration with a RN. In addition, the results showed that NPs, PAs, and RNs may all contribute to perceived quality of healthcare in their own unique way.

Finally, **Chapter 8** provides an overall discussion of the main findings of the thesis. Also the methodological reflections, implications for practice and policy and the recommendations for education and future research are described. This thesis shows that NPs and PAs in healthcare for older people are able to substitute GPs or ECPs largely autonomously with at least maintenance of quality of healthcare. RNs are able to prepare work for physicians and to support them. The results of our research also show that overuse, in RN cases, and underuse, in NP and PA cases of competences existed because of unfamiliarity among the professionals themselves, other professionals, managers and policy makers. They were unfamiliar with job content and qualifications of NPs, PAs and RNs and with the legal frameworks of substituting responsibilities. NPs, PAs and RNs all have their own unique added value as they contribute to quality of healthcare, provide person centered care and strengthen the care team. Substituting physicians with NPs, PA or RNs is a possible solution to the high workload and shortage of physicians in healthcare for older people and it provides opportunities for physicians to fulfill a more coordinating role. They can also fulfill a role as clinical expert for older people with more complex needs. However, a limited focus on substitution does no justice to person centered care and does not contribute to the right care in the right place by the right person. A vision on how to organize person centered healthcare for older people should be the starting point of care and this vision should be translated into the most optimal skill mix. Changes in skill mix by introducing NPs, PAs or RNs can only be successful if stakeholders are familiar with these functions and legislation, and if functions are embedded in the new model of care including funding.

SAMENVATTING

Zowel wereldwijd als in Nederland veroudert de bevolking. Door deze vergrijzing en het feit dat de kans op het ontwikkelen van een chronische ziekte groter wordt met het toenemen van de leeftijd, is het de verwachting dat het aantal ouderen met een chronische ziekte en multimorbiditeit zal toenemen. Tegelijkertijd willen veel ouderen graag thuis blijven wonen. In Nederland en in andere ontwikkelde landen vinden hervormingen van de overheid plaats, waardoor zorg wordt verplaats van ziekenhuizen en langdurige zorginstellingen naar de wijk. Door deze hervormingen en het groeiend aantal ouderen, neemt de druk op de eerstelijnszorg en de verpleeghuiszorg om passende zorg te leveren toe. Echter, weinig geneeskunde studenten zijn geïnteresseerd in de ouderenzorg. Als antwoord op deze uitdagingen is destijds voorgesteld om taken van huisartsen en specialisten ouderengeneeskunde (SO's) te herschikken naar verpleegkundig specialisten (VS'en), physician assistants (PA's) en verpleegkundigen[1]. Taakherschikking betekent het structureel herverdelen van taken tussen beroepen waarbij ook verantwoordelijkheden worden overgedragen. De zorgverlener die hierbij taken overneemt is gekwalificeerd om zelfstandig te werken. Taakherschikking moet overigens niet verward worden met taakdelegatie waarbij taken in opdracht en onder supervisie worden uitgevoerd. Er is behoefte aan kennis over de impact en organisatie van taakherschikking in de ouderenzorg om zorgverleners, manager en beleidsmakers in staat te stellen om onderbouwde beslissingen te nemen over taakherschikking.

Het centrale doel van dit proefschrift is inzicht geven in de impact van taakherschikking van artsen naar VS'en, PA's of verpleegkundigen in de ouderenzorg en hoe deze taakherschikking kan worden georganiseerd.

Hoofdstuk 2 presenteert het studieprotocol van een systematische literatuurstudie. In deze literatuurstudie is het effect geëvalueerd van taakherschikking in de eerstelijns ouderenzorg en de verpleeghuiszorg en zijn bevorderende en belemmerende factoren voor de implementatie van taakherschikking beschreven. In de literatuurstudie werden Cochrane-methodes toegepast. De volgende databanken werden doorzocht van januari 1995 tot augustus 2015 naar originele onderzoeksstudies waarin kwantitatief een vergelijking werd gemaakt tussen de zorg zoals verleend door een arts en dezelfde zorg verleend door een VS, PA of verpleegkundige: PubMed, EMBASE, CINAHL, PsycINFO, CENTRAL en Web of Science. Studieselectie, data-extractie en kwaliteitsbeoordeling werden door twee onderzoekers onafhankelijk uitgevoerd. De verzamelde uitkomsten waren: patiënten uitkomsten, zorgprocesuitkomsten, zorgverlenersuitkomsten,

1 In dit proefschrift: verpleegkundige met een specialisatie in de ouderenzorg, zoals: praktijkverpleegkundige, praktijkondersteuner, geriatrie verpleegkundige, hbo-verpleegkundige gerontologie en geriatrie en wijkverpleegkundige

zorggebruik, kosten en beschrijvingen van de implementatie. De synthese van de gegevens bestond uit een narratieve samenvatting.

Hoofdstuk 3 beschrijft de resultaten van de systematische literatuurstudie. In totaal werden er 11.340 artikelen gevonden waarvan er 12 studies werden geïncludeerd. Twee studies hadden een randomized controlled design (RCT) en tien studies pasten andere vergelijkende designs toe. Het jaar van publiceren varieerde van 1997 tot 2015. De meeste studies waren uitgevoerd in de Verenigde Staten, gevolgd door een studie in Canada, Zweden en Japan. Zeven studies vonden plaats in een verpleeghuis. In vijf van deze studies was de zorgverlener een VS, in één een PA en in één studie waren zowel een VS als PA ingezet. De andere vijf studies werden uitgevoerd in de eerste lijn; in drie van deze studies was de zorgverlener een VS, in één een verpleegkundige en in één studie waren zowel een VS als PA ingezet. Twee van de tien studies met een ander vergelijkend design waren van lage methodologische kwaliteit en werden geëxcludeerd voor de effectanalyse. De volgende uitkomsten werden meegenomen in dit onderzoek: 1) patiënten uitkomsten zoals kwaliteit van leven en mortaliteit; 2) zorgprocesuitkomsten zoals score op kwaliteitsindicatoren en percentage uitgevoerde preventieactiviteiten; en 3) zorggebruik zoals medicatiegebruik en aantal ziekenhuisopnames. In geen van de geïncludeerde studies werden zorgverlenersuitkomsten zoals werkdruk en tevredenheid meegenomen. De RCTs lieten zien dat taakherschikking naar een verpleegkundige, VS of PA een vergelijkbaar effect had als zorg van een arts op ongeveer de helft van de uitkomsten en een positief effect op de andere helft van de uitkomsten. Deze bevindingen werden ondersteund door de overige studies met uitzondering dat twee studies een toename in het aantal acute ongeplande visites liet zien wanneer taakherschikking werd ingezet. Kosten werden slechts in twee studies meegenomen: één RCT liet lagere kosten zien bij taakherschikking en in de andere studie had taakherschikking geen effect op de kosten. De implementatie werd beïnvloed door maatschappelijke, organisatie en individuele factoren.

Hoofdstuk 4 presenteert een kwalitatieve studie die beschrijft hoe veranderingen in de teamsamenstelling door de introductie van VS'en, PA's en verpleegkundigen in de eerstelijns ouderenzorg wordt georganiseerd, door welke factoren dit beïnvloed wordt en wat de ervaren effecten zijn. Vijf focusgroepen en 14 individuele interviews vonden plaats. In totaal werden 34 zorgverleners werkzaam in de eerstelijns ouderenzorg geïnterviewd: huisartsen (n=9), VS'en (n=10), PA's (n=5) en verpleegkundigen (n=10). De analyse bestond uit open coderen, categorieën creëren en abstractie. VS'en, PA's en verpleegkundigen zorgden voor een reeks van verschillende patiëntenpopulaties, waarbij slechts een klein deel van hun werk zich focuste op thuiswonende ouderen. PA's waren in dienst van de huisartsenpraktijk, terwijl VS'en en verpleegkundigen ook in dienst waren van thuiszorgorganisaties. De taken die deze professionals uitvoerden

en hun verantwoordelijkheden in de ouderenzorg verschilden zowel tussen als binnen de verschillende beroepen. Een duidelijke visie op de eerstelijns ouderenzorg, inclusief de organisatie van proactieve zorg en de rol van elke professionals bleek te ontbreken. Veranderingen in de teamsamenstelling werden ook beïnvloed door een gebrek aan gezamenlijk optreden, samenwerking, vertrouwen en acceptatie van elkaars expertise onder VS'en, PA's, verpleegkundigen en huisartsen, en onbekendheid van de ouderen en hun familie met de functie van VS'en, PA's en verpleegkundigen. Desalniettemin gaven de geïnterviewden aan dat VS'en, PA's en verpleegkundigen een toegevoegde waarde hadden op kwaliteit van zorg, patiëntgerichtheid, en ondersteuning van de zorgteams/ wijkteams. Ook bleek dat de rol van de huisarts veranderde door de introductie van de VS'en, PA's en verpleegkundigen.

Hoofdstuk 5 presenteert een kwalitatieve studie die beschrijft hoe veranderingen in de teamsamenstelling door de introductie van VS'en, PA's en verpleegkundigen in verpleeghuizen wordt georganiseerd, door welke factoren dit beïnvloed wordt en de ervaren effecten. Vier monodisciplinaire en één multidisciplinaire focusgroep werden uitgevoerd met in totaal 32 zorgverleners: SO's (n=9), VS'en (n=10), PA's (n=6) en verpleegkundigen (n=7). De analyse bestond uit open coderen, categorieën creëren, en abstractie. Er werd een variatie in taken en verantwoordelijkheden gezien. Alle VS'en, PA's en verpleegkundigen werkten op afdelingsniveau, terwijl sommigen ook op een specifiek aandachtsgebied werkten op organisatieniveau. PA's namen een brede reeks (complexe) taken over van SO's. Onder VS'en was er variatie in verantwoordelijkheden, van alleen taken uitvoeren volgens protocol tot het zelfstandig uitvoeren van meer complexe taken. De verpleegkundigen bereidden met name het werk van de SO's voor en ondersteunden de SO's. Er was ook variatie in de manier waarop VS'en, PA's en verpleegkundigen samenwerkten met SO's. Ondanks deze variatie beschreven de geïnterviewden toegenomen kwaliteit van zorg, patiëntgerichtheid en ondersteuning van de zorgteams, als ook kansen voor SO's om meer een regie rol te vervullen. De organisatie van de veranderingen in de teamsamenstelling in verpleeghuizen bleek te worden beïnvloed door het gebrek aan een visie op deze verandering, gebrek aan acceptatie van VS'en, PA's en verpleegkundigen door andere zorgverleners, ouderen en familie, persoonlijke factoren van de betrokken zorgverleners en verwarring over de wettelijke consequenties van taakherschikking.

Hoofdstuk 6 presenteert het studieprotocol van een multiple-case studie volgens de principes van 'realist evaluation', waarbij het gaat om wat werkt, in welke context en hoe het werkt. Deze studie had als doel inzicht te verkrijgen in de vormgeving van taakherschikking in verpleeghuizen en of het bijdraagt aan de ervaren kwaliteit van zorg. Ten tweede had deze studie als doel inzicht te geven in die elementen van taakherschikking die bijdragen aan de kwaliteit van zorg. In het protocol wordt een initiële

theorie gepresenteerd bestaande uit drie mechanismen: 1) gebaseerd op hun opleiding en voorgaande ervaring zijn VS'en, PA's en verpleegkundigen in staat om zelfstandig taken van SO's over te nemen; 2a) taakherschikking is altijd een samenwerking tussen de VS, PA of verpleegkundige en de SO; 2b) de rol van de SO verandert door de samenwerking met de VS, PA of verpleegkundige; 3) VS'en, PA's en verpleegkundigen hebben een andere manier van werken en voeren aanvullende taken uit ten opzichte van de SO. Om deze theorie te verfijnen werden zeven cases geselecteerd op basis van maximum variatie sampling. De primaire participanten waren VS'en, PA's en verpleegkundigen. SO's, basisartsen, directeuren/managers/leidinggevenden, zorgteamleden en bewoners/familie waren de secundaire participanten. Dataverzameling bestond uit observaties, interviews, vragenlijsten en analyse van interne beleidsdocumenten. Bij voltooiing van elke case werd er een single-case analyse uitgevoerd, gevolgd door een cross-case analyse aan het eind van de studie.

Hoofdstuk 7 beschrijft de resultaten van de multiple-case studie. De zeven cases omvatten drie VS'en, twee PA's en twee praktijkverpleegkundigen. Een optimaal model van taakherschikking lijkt een model waarin de professional zelfstandig taken van de SO overneemt, er een samenwerking tussen de SO en de professional is die goed in balans is, en waarbij kwaliteit van zorg gehandhaafd is. Dit model werd gezien in twee VS-cases en één PA-case. Elementen die VS'en en PA's in staat stelden om volgens dit optimale model te werken waren onder andere: samenwerking met de SO die op vertrouwen gebaseerd is; proactief, besluitvaardig en communicatief zijn; en ondersteund zijn door de leiders in de zorgorganisatie om te werken als een zelfstandige professional. Een succesvolle samenwerking tussen de VS of PA en de SO verminderde de medische taken van de SO en droeg voor de SO bij aan meer tijd voor aanvullende taken zoals multidisciplinaire overleg met eerstelijns professionals. De verpleegkundigen namen niet zelfstandig medische taken over van de SO/basisarts met behoud van kwaliteit van zorg. SO's/basisartsen voerden in de cases met verpleegkundigen echter wel minder taken uit op het grensvlak van het medisch en verpleegkundig domein, bijvoorbeeld wondzorg. Bovendien lieten de resultaten zien dat VS'en, PA's en verpleegkundigen allen, op hun eigen unieke manier, kunnen bijdragen aan de ervaren kwaliteit van zorg.

Ten slotte beschrijft **hoofdstuk 8** een algemene discussie van de belangrijkste bevindingen uit dit proefschrift. Ook worden methodologische reflecties, implicaties voor praktijk en beleid en aanbevelingen voor onderwijs en toekomstig onderzoek beschreven. Dit proefschrift laat zien dat taakherschikking van huisartsen en SO's naar VS'en en PA's in de ouderenzorg mogelijk is met behoud van kwaliteit van zorg. Verpleegkundigen zijn in staat om het werk voor artsen voor te bereiden en hen te ondersteunen; hierbij is eerder sprake van taakdelegatie dan taakherschikking indien de verantwoordelijkheden niet overgedragen worden. De resultaten lieten echter ook zien dat overvraging van

verpleegkundigen en ondervraging van VS'en en PA's voorkomt door onbekendheid met de inhoud van de functies en bijbehorende wetgeving onder deze professionals zelf, als ook onder andere professionals, manager en beleidsmakers.

VS'en, PA's en verpleegkundigen hebben allen hun eigen unieke toegevoegde waarde doordat ze bijdragen aan de kwaliteit van zorg, persoonsgerichte zorg leveren en het zorgteam versterken. Taakherschikking is een mogelijke oplossing voor de hoge werkdruk en het tekort aan artsen in de ouderenzorg en het biedt kansen voor artsen om meer een regierol te vervullen. SO's kunnen ook een rol vervullen als klinisch expert voor ouderen met complexere zorgvragen en in de eerstelijns ouderenzorg. Echter, een beperkte focus op taakherschikking doet geen recht aan persoonsgerichte zorg en draagt niet bij aan de juiste zorg op de juiste plek door de juiste persoon. Een visie op de organisatie van persoonsgerichte zorg voor ouderen zou het startpunt moeten zijn van zorg en deze visie zou vertaald moeten worden in de meest optimale teamsamenstelling. Veranderingen in de teamsamenstelling door de introductie van VS'en, PA's en verpleegkundigen kunnen alleen succesvol zijn als de betrokkenen bekend zijn met deze functies, de wetgeving, jurisprudentie en als de functies zijn ingebed in het nieuwe zorgmodel inclusief financiering.

DANKWOORD

Veel mensen hebben bijgedragen aan de totstandkoming van dit proefschrift, waarvoor heel veel dank. Ik wil een aantal mensen in het bijzonder noemen.

Allereerst gaat mijn dank uit naar iedereen die heeft deelgenomen aan dit onderzoek. Dank aan alle zorgverleners, cliënten, bewoners en andere betrokkenen uit de ouderenzorg. Zonder jullie medewerking, openheid en vertrouwen hadden we dit onderzoek nooit kunnen uitvoeren.

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Anneke van Vught, officieel was je geen lid van het promotieteam, maar gevoelsmatig wel. We hebben samen uren interviews gecodeerd waarbij jouw kennis over taakherschikking en jouw scherpe en kritische blik heel goed van pas kwamen. Jij bent een heel belangstellend en hartelijk persoon. Ik ben enorm blij dat we ook in de toekomst samen mooie projecten mogen uitvoeren.

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Prof. dr. M.G.M. Olde Rikkert, prof. dr. R.S. Batenburg en prof. dr. S.M.G. Zwakhalen. Jullie vormden samen de manuscriptcommissie die dit proefschrift beoordeeld en goedgekeurd heeft. Mijn hartelijke dank hiervoor.

Dank aan alle leden van de klankbordgroep 'Taakherschikking in de ouderenzorg' voor het meedenken en de kritische feedback op het onderzoek. De input vanuit de verschillende hoeken van praktijk, onderwijs en beleid heeft het onderzoek enorm verrijkt.

Er zijn teveel collega's om individueel te bedanken, maar wat heb ik het de afgelopen jaren gewaardeerd dat ik steeds zulke leuke collega's trof (eerst bij IQ healthcare en later bij het UKON en de HAN) die oprecht geïnteresseerd waren in mij en mijn promotieonderzoek. Heel fijn om lief en leed te kunnen delen met elkaar. Dank daarvoor.

Lieve vrienden, wat ben ik gezegend met zulke lieve, leuke mensen om mij heen. Bedankt voor jullie interesse en vooral ook voor de ontspanning, gezellige momenten en leuke activiteiten. Twee in het bijzonder, mijn paranimfen: Annelies Wassenaar, ik zie ons nog zitten in het kamertje van Lisette tijdens onze afstudeerfase van de master Verplegingswetenschap. Onervaren onderzoekers, maar heel gedreven. Ons praatje na zo'n afspraak duurde vaak langer dan de afspraak zelf. We hadden altijd zoveel te bespreken! Dit is ook tijdens onze promotietrajecten zo gebleven en ik wil je danken voor al je steun, tips en fijne gesprekken. Ellen te Molder, we kennen elkaar bijna ons hele leven en hebben al zoveel samen meegemaakt. Ik kan me niet voorstellen dat ik een belangrijke stap in mijn leven zet zonder dat jij daar bij bent. Dank voor wie je bent! Ik vind het heel fijn dat jullie tijdens mijn verdediging naast mij willen staan.

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voor je relativeringsvermogen. Het is fijn om met jou te filosoferen en debatteren over van alles en nog wat.

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Lieve Stefan, jij hebt me op wel meer dan honderd verschillende manieren geholpen met dit proefschrift. Van het mogelijk maken dat ik mijn master studie kon volgen, tot het op zaterdag boodschappen doen met Noud zodat ik in alle rust mijn proefschrift kon afronden. Bedankt daarvoor, en voor al het andere. Ik hou van jou!

CURRICULUM VITAE

Marleen Lovink is geboren op 1 september 1987 in Zelhem. In 2005 behaalde zij haar VWO diploma, waarna ze startte met de studie verpleegkunde aan de Hogeschool Windesheim in Zwolle. Na het behalen van haar bachelor in 2010 ging zij werken als dialyseverpleegkundige in opleiding in het Radboudumc in Nijmegen. In 2011 sloot ze de opleiding tot dialyseverpleegkundige cum laude af. Vanaf dat moment combineerde zij haar werk als dialyseverpleegkundige met het volgen van de master Verplegingswetenschap aan de Universiteit Utrecht. In het kader van haar afstuderen deed zij een kwalitatief onderzoek naar hoe hemodialysepatiënten hun veiligheid ervaren tijdens de behandeling. In 2013 behaalde zij haar masterdiploma.

In 2014 startte Marleen haar promotieonderzoek bij het Scientific Center for Quality of Healthcare (IQ healthcare) van het Radboudumc in Nijmegen. Hier heeft zij onderzoek gedaan naar de impact en organisatie van taakherschikking van artsen naar verpleegkundig specialisten, physician assistants en verpleegkundigen in de ouderenzorg, waarvan dit proefschrift het eindresultaat is.

Naast haar werk als promovenda was zij voorzitter van het junioren overleg van IQ healthcare en extern lid van de kenniskring van het Lectoraat Organisatie van Zorg en Dienstverlening (OZD) van de Hogeschool van Arnhem en Nijmegen (HAN). Daarnaast werkte zij voor de masteropleiding Physician Assistant van de HAN als werkgroep- en afstudeerbegeleider.

Op dit moment werkt Marleen als onderzoeker bij het Lectoraat OZD van de HAN en bij het Universitair Kennisnetwerk Ouderenzorg Nijmegen (UKON) van het Radboudumc.

PUBLICATIONS

Lovink MH, Persoon A, van Vught AJAH, Koopmans RTCM, Schoonhoven L, Laurant MG. Physician substitution by mid-level providers in primary healthcare for older people and long-term care facilities: protocol for a systematic literature review. *Journal of Advanced Nursing 2015; 71(12): 2998 3005*.

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Lovink MH, Kars MD, de Man-van Ginkel JM, Schoonhoven L. Patients' experiences of safety during haemodialysis treatment - a qualitative study. *Journal of Advanced Nursing 2015*; 71(10):2374-2383.

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Van Vught AJAH, **Lovink MH**, Laurant MG. Taakherschikking in verpleeghuizen, kansen, belemmeringen en effecten. *Dé Verpleegkundig Specialist, nummer 1, maart 2018.*

Van Vught AJAH, **Lovink MH**, Koopmans RTCM, Persoon A, Laurant MG. Physician assitants en verpleegkundig specialisten in verpleeghuizen. Een studie naar kansen, belemmeringen en effecten. *Tijdschrift voor ouderengeneeskunde, nummer 3, juni 2019.*

Lovink MH, Huisman-de Waal G, Smits M, van Vught AJAH. EBP in het verpleeghuis: het EVIDENCE-project. *TvZ, nummer 4, 2019.*

Maessen K, van Vught AJAH, Gerritsen DL, **Lovink MH**, Vermeulen H, Persoon A. Development and validation of the Duthc EBPAS-ve and EBPQ-ve for Nursing Assistants and nurses with a vocational education. *Worldviews on Evidence Based Nursing 2019*; [Epub ahead of print].

PHD PORTFOLIO

Name PhD student: M.H. Lovink Department: IQ Healthcare Graduate School: Radboud Institute for Health Sciences	PhD period: 01-02-2014 – 1-10-2017 Promotoren: Prof. dr R.T.C.M. Koopmans, Prof. dr. L. Schoonhoven Co-promotoren: dr. M.G.H. Laurant, dr. A. Persoon	
	Year(s)	ECTS
TRAINING ACTIVITIES		
a) Courses & Workshops		
- ***EndNote Medische Bibliotheek***	2014	0.1
- ***RIHS Introduction course for PhD students***	2014	1.0
- ***Systematic reviews en meta-analsye EpidM***	2014	1.0
- ***Focusgroepen, Evers Research & Training***	2014	1.0
- ***Academic writing***	2014/2015	3.0
- ***Effectieve planning***	2015	1.0
- ***Scientific integrity***	2015	1.0
- ***The art of presenting Science***	2015	1.5
- ***BROK***	2016	1.5
b) Seminars & lectures		
c) Symposia & congresses		
- ***PhD retreat (poster)***	2014	
- ***Summer Course HAN (oral)***	2014	
- ***V&VN VS jaarcongres (oral)***	2014	
- ***International Congress Advanced Practice Nursing & Advanced Nursing Practice, München (oral)***	2015	
- ***Verenso jaarcongres (poster + oral)***	2015+2017	
- ***Netwerkdag VS verpleeghuis (oral)***	2015+2017	
- ***Symposium V&VN Wetenschap in Praktijk (oral)***	2015	
- ***European Nursing Congress, Rotterdam (oral)***	2016	
- ***Gerion (oral)***	2018	
- ***Voson (oral)***	2019	
d) Other		
- ***Voorzitter junioren overleg IQ healthcare***	2014-2016	
- ***Managementteamlid IQ healthcare namens junioren overleg***	2015-2016	
- ***Extern Kenniskringlid lectoraat Organisatie van Zorg en Dienstverlening, Hogeschool van Arnhem en Nijmegen***	2014-2017	
- ***Journal club 'Taakherschikking' Radboudumc/Hogeschool van Arnhem en Nijmegen***	2015 - 2017	
TEACHING ACTIVITIES		
e) Lecturing		
- ***Master Physician Assistant: begeleiden werkgroepen en alumni bijeenkomsten***	2015-2017	
f) Supervision of internships / other		
- ***Onderzoeksmedewerkers***	2014-2017	
- ***Hbo-v studenten***	2015-2016	
- ***Master Physician Assistant studenten***	2015-2017	
TOTAL		**11.1**

DATA MANAGEMENT

Bij het opslaan en gebruik van data zijn de richtlijnen gevolgd zoals vastgelegd in het Qportaal kwaliteit van IQ healthcare. Deze richtlijnen zijn gebaseerd op de Nederlandse Gedragscode Wetenschapsbeoefening van VNSU (2014).

Beveiligde data opslag
Alle originele gegevens als ook bestanden voor analyse en meetinstrumenten zijn opgeslagen op de H:/schijf IQ healthcare in map ouderenzorg.
Deze map is alleen toegankelijk voor de betrokken onderzoekers en data zijn geanonimiseerd opgeslagen.
Alle naar persoon of organisatie (i.e. participanten onderzoek) herleidbare data zijn verwijderd.

Na afronding van de laatste publicatie wordt alle data opgeslagen op de k:/schijf IQ healthcare (archiveringsschijf). Alle opgeslagen gegevens worden voor een periode van 10 jaar bewaard.

Dr. M.G.H. Laurant is projectleider en wordt na 10 jaar geïnformeerd door secretariaat over afloop van de bewaartermijn. Zij neemt besluit of data kan worden vernietigd of indien gewenst, de data voor langere periode beschikbaar moet blijven (bewaartermijn wordt dan opnieuw vastgesteld) dan wel via openbare databases (bv. DANS Easy) wordt aangeboden.

Radboudumc is verantwoordelijk voor dagelijkse back-up van de files, h:/schijf en k:/schijf.

Informed consent
Alle informed consent formulieren zijn als papieren versie opgeslagen in een afgesloten kast. Informed consent is verkregen voor (focusgroep) interviews en multiple-case study (uitgezonderd observaties van niet primaire participanten, hiertoe is alleen mondelinge toestemming verkregen).

Soort data
Kwantitatief:
Vragenlijsten, opgeslagen op de h:\schijf
De data zijn verwerkt in SPSS en opgeslagen in *.sav* bestanden.

Kwalitatief:
Interviews, opgeslagen op de h:\schijf.

De geluidsopnames zijn opgeslagen als *.mp3* bestanden. Ook zijn alle transcripten opgeslagen. Analyss zijn uitgevoerd met Atlas.ti, transcripten zijn ingelezen en gecodeerd. Deze bestanden zijn opgeslagen als *.atlcb* en *.hpr7* bestanden, inclusief back-ups.
Observaties zijn opgeslagen in word, *.docx* bestanden.

Literatuurstudie:
De zoekstrategie is per literatuur database opgeslagen in word, idem de resultaten van de zoekstrategie zijn per literatuurdatabase opgeslagen in EndNote, *.enl* bestanden.
Alle full-tekst artikelen geïncludeerde studies zijn opgeslagen als .pdf bestanden.
Alle data-extracties zijn opgeslagen in excel, *.xlsx* bestanden en tabellen in word *.docx* bestanden.

Beschikbaarheid data
Alle data is 'on reasonable request' bij de co-promotor dr. M.G.H. Laurant beschikbaar. Zij zal bij verzoek overleggen met de promovenda M. Lovink of data in openbare database (bv. DANS Easy) beschikbaar worden gesteld.