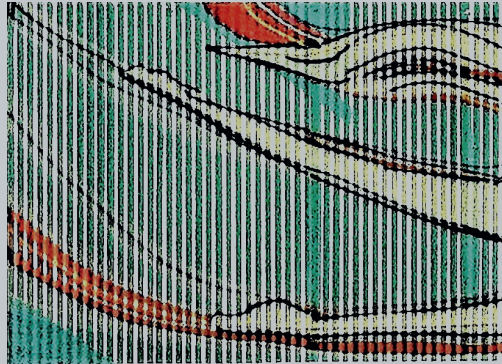


The Impact of
Nurse Practitioners
in Primary Care
Mieke van der Biezen



The Impact of Nurse Practitioners in Primary Care

"Once we rid ourselves of traditional thinking
we can get on with creating the future"

James Bertrand

For reasons of consistency within this thesis, some terms have been standardised 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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CHAPTER

1

General

introduction

GENERAL INTRODUCTION

Finding the proper model for health-care delivery is an ongoing process, determined by many factors such as politics, changing patient demands and shifting professional roles. There is a strain on primary health care whose challenges are recognised as increasing demands for care due to an ageing population, more patients with chronic complaints, and reforms that shift care from hospitals to the community.¹⁻³ In the face of these developments, tasks have increasingly been delegated from general practitioners (GPs) to nurses and other staff.⁴ The role of nurse practitioners (NPs) was introduced in the Netherlands in 2000 in order to provide career options for nurses, as a possible solution to physician shortages and to save health-care costs.⁵ These Master's-educated professionals provide specialist nursing care and medical care within a defined domain.⁶ The introduction of NPs has the potential to contribute to the quality, sustainability and efficiency of the primary health-care system. The overall aim of this thesis is to explore the viability and impact of integrating NPs in primary healthcare.

CHALLENGES IN PRIMARY CARE

As in the majority of western countries, primary care in the Netherlands is traditionally delivered by GPs, but the number of nurses and other personnel is rising.^{7,8} Almost 100 per cent of Dutch citizens are registered with a general practice. GPs are, 24 hours a day, the first point of contact for care for all medical complaints, and referral from a GP is required for secondary care.⁴ Moreover, more than 90 per cent of all care takes place in primary care just four per cent of the total health-care budget.⁹ GPs' professional organisations regard a generalist role, person-centred care, and continuity in care as upholding the core values of primary healthcare.¹⁰ Their goal is to keep the population healthy through the prevention and timely treatment of complaints, and the management and coordination of care for chronically ill patients.¹¹ A primary health-care system that works well is key to continuity of care and to controlling the costs of healthcare. The Netherlands is known for its strong primary health-care system but, like other western countries, it faces challenges.

Firstly, there is an increasing demand for primary care: ageing populations result in more patients with chronic complaints and multi-morbidity, and at the same time older people are living longer in their homes. Secondly, there are reforms that shift care from hospitals to primary care and there is increased pressure for GPs to participate in preventive community-based projects. It is not only debatable whether the current primary care delivery model is sustainable, but also whether it is the most

adequate model to meet all demands. The demands place a heavy burden on GPs' workload, while not all care which is now delivered by GPs actually requires the knowledge and skills of a GP. Examples include care for patients with minor ailments or social home visits. With a need to increase the workforce in primary care, to comply with the increasing demand and to improve the accessibility of care, further change in the so called skills-mix is one option.

NURSES IN DAYTIME PRIMARY CARE

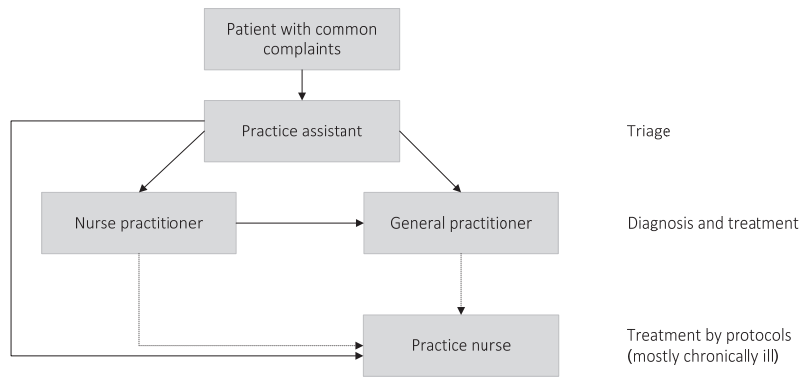
In the Netherlands, primary care during office hours is delivered in small-scale general practices. Although 81 per cent of GPs still work solo or with one other GP, the proportion of GPs working in partnership has been growing.^{4,12} In addition, care in general practice is delivered by a team including other health-care professionals. In the 1950s, medical assistants were introduced into general practice and, in the last two and a half decades, their role has expanded due to increasing education levels in performing medical-technical tasks and patient education.¹³ In 1999, registered nurses (Bachelor's level) were introduced in general practice in the role of practice nurse to take care of patients with chronic conditions. Nowadays, almost all general practices deploy practice nurses to take care of patients with chronic conditions (especially diabetes, asthma/COPD and cardiovascular disease) or mental health complaints.⁹ Practice nurses provide a role complementary to the GP, particularly in care for patients with chronic disease. The introduction of practice nurses has led to an increase in quality of care (for example, patients with asthma/COPD receive patient counselling more often and better monitoring), but has not decreased GPs' workload.¹⁴ Moreover, practice nurses work under the supervision of a GP and provide only care that fits into evidence-based guidelines.

NURSE PRACTITIONERS IN PRIMARY CARE

In 2001, the NP (who has a Master's degree) was introduced in the Netherlands. The NP distinguished him/herself from registered nurses by three criteria: independence, expertise and an active attitude to role development.¹⁵ NPs have the authority to indicate independently and to perform reserved procedures ((i.e. catheterization, cardioversion, defibrillation, endoscopy, injection, puncture, prescribing medicines and simple surgical procedures)) in their area of expertise using the same guidelines as GPs.^{6,16} Therefore, they can take over certain GP tasks without GPs' supervision. Often tasks include more straightforward care, but this is highly dependent on the context of care. In the Netherlands, the title 'Nurse Practitioner' is protected by law and

exclusively reserved for those who have completed a two-year Master’s programme called the Higher Professional Education Master’s Degree in Advanced Nursing Practice and who are registered in the specialist register. Figure 1 shows their roles in primary care practices during office hours.

Figure 1. The NPGP Model (Derckx, Toemen 2005)



International research shows that NPs are capable of providing 67–93 per cent of all primary care to patients, given their training and clinical expertise.¹⁷ Although the number of rigorous evaluations remains low, systematic reviews suggest that substitution of GPs by NPs is associated with higher patient satisfaction, lower overall mortality and fewer hospital admissions. Care given by NPs has proved to be both effective and safe, although not necessarily less expensive.^{1,18,19} Although the extant studies show positive outcomes for care delivered by NPs, there are also concerns regarding the deployment of NPs in primary care. For example, some argue that NPs might be less efficient in terms of consultation times, that team collaboration might be reduced if the NP role is not accepted, that GPs may lose clinical skills with respect to specific patients, and that the complexity in GPs’ caseload might be increased due to NPs taking on less complex patients.²⁰⁻²²

The deployment of NPs in primary care is observed internationally, but the speed of the process differs between countries and between regions within countries.^{7,17,23,24} Research among 39 countries shows that task-shifting from physicians to nurses in primary care has been observed in two-thirds of all countries. The development of advanced nursing roles in health-care delivery and the promotion of task-shifting are nevertheless ongoing globally, and have been supported by policy makers and

regulatory and educational reforms.²⁵ Task-shifting between NPs and GPs is being widely implemented to help meet the demand for primary care and reduce the work burden on GPs, which enables GPs to utilize their training and experience effectively by focusing on the most vulnerable and complex patients.^{26,27}

In the Netherlands, most NPs work in hospital settings and their implementation in primary care is still at a pioneering stage.^{28,29} In 2016, there was one fulltime-equivalent NP in relation to 100 fulltime-equivalent GP.³⁰ Currently, there is limited insight in respect of reasons for GPs in the Netherlands to employ NPs in their practice.

NURSE PRACTITIONERS IN OUT-OF-HOURS PRIMARY CARE

As mentioned earlier, GPs in the Netherlands are the gatekeepers for secondary care 24 hours a day and out-of-hours care is therefore, like in the majority of western countries, organised in general practitioner cooperatives (GPC). Out-of-hours care differs from care during office hours because the spectrum of patient complaints is different and the scale of organisation is much larger. In contrast to the small-scale general practices during office hours, there are between 40 and 250 GPs from each GPC-affiliated region. Full-time GPs are, on average, on call twice a month for six to eight hour shifts to deliver care during the evening, night or weekend hours for populations ranging from 100,000 to 500,000 citizens.³¹⁻³³ Therefore, teams at the GPC differ in every shift and often the team members are unfamiliar with each other or with each other's competencies. In addition, they typically do not know the patients seeking out-of-hours care.

Although GPCs show positive results, the current and expected problems like ageing, increased prevalence of chronic conditions and task shifts from hospitals to the community also put pressure on out-of-hours care.³⁴⁻³⁶ Policy makers are challenged to find a care delivery model that ensures accessibility, quality and efficiency of out-of-hours care.^{37,38} Internationally as well as in the Netherlands, a growing number of out-of-hours models deliver care in teams involving both GPs and NPs.³⁹ NPs are considered to be sufficiently skilled to do shifts at the GPC and to provide care for certain patients who would otherwise have received GP treatment. This either relieves GPs' burden of work in terms of number of shifts, or increases service capacity. However, the introduction of NPs in teams in those settings in the Netherlands is relatively new and their impact on team-based care and patient care is yet unknown. Most evidence on NPs in primary care is conducted in care during office hours. Results for NPs in care during office hours cannot simply be translated to out-of-hours care.

Organisations differ in size, the incidence of life-threatening conditions is higher in the out-of-hours setting, and care outside office hours has unpredictability in patient flow. Therefore, research is needed to provide insight into the impact of NPs in out-of-hours primary care.

AIM OF THE THESIS

This thesis focuses on the viability and impact of NP deployment in primary health care during both regular office hours and out-of-hours. With several studies, we aim to provide insight into:

- The effects on patient outcomes, process of care, resource utilization and costs of substituting doctors with nurses in primary healthcare.
- Factors influencing the decision of GPs and managers to train and employ a PA/NP within their organisation.
- The number and type of patients treated by the NP in out-of-hours care, and the impact on GPs' caseload.
- The effect of substituting GPs with NPs in out-of-hours care on resource use, production and health-care costs.
- The comparison of teams with different ratios of GPs and NPs on the number of consultations, patient care and GPs' performance features, and insight into the number of patients who are outside NPs' scope of practice in out-of-hours primary care.
- Which factors influence collaboration between GPs and NPs in different team structures during out-of-hours and how this impacts patient care.

OUTLINE OF THE THESIS

This thesis begins with providing insight into the outcomes associated with care delivered by nurses in primary care. **Chapter 2** presents the results of a comprehensive systematic review on the impact of nurses as GPs' substitutes on patient outcomes, process of care, resource utilization and costs. This is followed by a focus on the implementation of NPs in primary care in the Netherlands. **Chapter 3** presents the results of a qualitative study to provide insight into factors influencing GPs' and managers' decision to train and employ a PA/NP within their primary care organisation. The largest part of this thesis (Chapters 4–7) focuses on the impact and viability of employing NPs in out-of-hours primary care. These studies provide insight

into GPs' and NPs' tasks and patient care (**Chapter 4**), the impact on resource use and health-care costs (**Chapter 5**), the optimal ratio of GPs and NPs in teams and its impact on patient care and GPs' caseload (**Chapter 6**), and team collaboration between GPs and NPs (**Chapter 7**). These studies together can be interpreted as a proof-of-concept study demonstrating the feasibility of NPs in out-of-hours primary care at one GPC. **Chapter 8** provides an overall discussion on the subject of this thesis, including the main findings, the strengths and limitations, and the implications for practice. The thesis concludes with a summary in English and in Dutch.

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Substitution of doctors by
nurses in primary care: a
systematic review and meta-
analysis

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ABSTRACT

Background: Current and expected problems like ageing, increased prevalence of chronic conditions and multi-morbidity, increased emphasis on healthy lifestyle and prevention and a substitution of care from hospitals to the community encourage countries worldwide to develop new models of primary care delivery. Due to the fact that many tasks do not necessarily require the knowledge and skills of a doctor, there is an increasing interest in nurses to expand the capacity of the primary care workforce. Substitution of doctors with nurses is one strategy for improving access, efficiency and quality of care. This is the first update of the Cochrane review published in 2005.

Objectives: Our aim was to investigate the impact of nurses working as substitutes for primary care doctors on outcomes for patients, processes of care and utilization, including cost.

Search methods: We searched the Cochrane Central Register of Controlled Trials (CENTRAL), part of the Cochrane Library, www.cochranelibrary.com, MEDLINE, Ovid, and CINAHL, EbscoHost (searched 20.01.2015). We reran slightly revised strategies, limited to publication year between 2015 and 2017, for CENTRAL, MEDLINE and CINAHL in March 2017. We searched for grey literature in the Grey Literature Report and OpenGrey (21.02.2017), and the trial registries ICTRP and ClinicalTrials.gov (21.02.2017). We did a cited reference search for relevant studies (searched 27.01.2015), and checked reference lists of all included studies.

Selection criteria: Randomised trials and evaluating the outcomes of nurses working as substitutes for doctors. The review is limited to primary health care services that provide first contact and ongoing care for patients with all types of health problems, excluding mental health problems.

Data collection and analysis: Data extraction and assessment of risk of bias of included studies was carried out independently by two reviewers. Where feasible, the study results were combined and an overall estimate of the effect was obtained. Other outcomes were evaluated through semi-quantitative synthesis.

Main results: This review identified 18 randomised trials evaluating the impact of nurses working as doctors' substitutes. One study was from a low-income country and all other studies were from high-income countries. The nursing level was often unclear or varied between and even within studies.

The findings suggest that care delivered by nurses, compared to care delivered by doctors probably generates similar or better health outcomes for a broad range of patient conditions (moderate certainty evidence):

- Mortality is probably decreased in nurse-led primary care.
- Blood pressure outcomes are probably improved in nurse-led primary care. Other clinical or health status outcomes are probably similar.
- Patient satisfaction and quality of life are probably slightly higher in nurse-led primary care.

Results suggest an improvement in processes of care associated with nurse-led care such as patient education and adherence to guidelines (moderate certainty evidence). However, an overall effect size could not be measured.

The effect of nurse-led care on utilization is mixed and depends on the type of outcome. Consultation length is probably longer in nurse-led primary care and attended return visits are probably slightly higher for nurses, compared to doctors (moderate-high certainty evidence). There is little or no difference between nurses and doctors in frequency of prescriptions, tests and investigations and in patients' use of other services as home visits (moderate certainty evidence). Nurse-led care may make little or no difference to cost of care compared to doctor-led primary care (low certainty evidence).

Authors' conclusions: This review shows that trained nurses, such as nurse practitioners, practice nurses and registered nurses, probably provide equal or possibly even better quality of care as primary care doctors and probably achieve equal or better health outcomes for patients. Nurses are likely to provide more health advice and are likely to achieve higher levels of patient satisfaction compared to primary care doctors. Furthermore, consultation length is likely to increase, as well as the frequency of return visits, but other utilization outcomes were likely the same. The financial impact of nurse-led primary care is still not clear. We cannot indicate what nursing education level will give the best outcomes when substituting for doctors.

BACKGROUND

Description of the condition

Current and expected problems like ageing, increased prevalence of chronic conditions and multi-morbidity, increased emphasis on healthy lifestyle and prevention and a substitution of care from hospitals to the community encourage countries worldwide to develop new models of primary care delivery.^{1,2} As many tasks do not necessarily require the knowledge and skills of a doctor, there is an increasing interest in nurses to expand the capacity of the primary care workforce.^{3,4} Substitution of doctors with nurses is one strategy for improving access, efficiency and quality of care.^{5,6} Advanced nursing practice roles are common in both high and low income countries.^{3,4} However, there is a strong variation in primary care practice compositions and the same professionals might have different roles and full practice authorities depending on practices, legislation and health-care systems.^{1,7,8} There are currently reforms being implemented in many countries regarding nurses' regulatory barriers or expanding nurses' scope of practice (e.g. prescribing medicines). These developments are ongoing and suggest a shift in the boundaries between medicine and nursing.³

Description of the intervention

Nurses in primary care may undertake many tasks traditionally performed by doctors. Tasks can either be supplementary to doctors or as substitute. The current review focuses on tasks in which nurses substitute for doctors, meaning they provide the same services as doctors^{8,9} and is limited to care delivery for patients presenting a physical complaint. Those tasks may include diagnostics, treatment, referral to other services, health promotion work, management of chronic diseases or management of acute problems needing same day consultations. Contact with patients may have taken place in the surgery or at the home of the patient. Because definitions and education levels of nurses differ worldwide,^{3,4} all registered nurses who provide care as substitutes of doctors are included in the current review. When available, the authors will provide insight on the education levels of nurses in the included studies, based on the European Qualification Framework. Moreover, both high and low income countries are included. The effect on heterogeneity will be described.

How the intervention might work

The expectation is that doctor substitution by nurses can:

- a. enhance the quality of services provided in primary care;
- b. increase access to primary care service, as capacity increases;
- c. reduce doctors' workload and thus free-up time for doctors to take up more complex tasks; and finally
- d. reduce costs of care, due to lower salary costs and educational training which is more quickly and less expensive.

The latter is, however, not confirmed by a previous systematic review on this intervention.¹⁰ Gains in service efficiency may be achieved if doctors no longer provide the services they have delegated to nurses. This enables doctors to focus on complexity in their caseload, utilising their training and experience.^{11,12}

Why it is important to do this review

Worldwide, both in high and low income countries advanced nursing practice roles have been developed.^{1,3,4} The first advanced nursing roles were developed in the United States and Canada in the late '60s/'70s, in 80s in the United Kingdom and other developed countries followed in '90s and onwards.⁸ From onset, these nurses have been utilized to deliver primary care, traditionally in underserved areas and to vulnerable populations. Nowadays their position has been extended to other types of services in primary care and is implemented in different countries around the globe.^{1,3,4,13}

Nurses in advanced roles represent a substantial source of human capital to increase quality of care, access to (primary) care and efficiency of care. Although the latter is not confirmed by recent reviews.^{10,14-17} It is believed that the inclusion of nurses in advanced roles ensures that the demand for health-care services and needs are properly met in both high and low income countries. Both practitioners as well as policy makers think that to meet the challenges primary care is facing, a more robust health-care workforce, including both doctors and nurses in advanced nursing roles, is needed.⁵

There is globally an increased interest in expanding nursing roles and employ nurses as doctors' substitutes although the underlying reasons to employ nurses in such roles may differ depending on the local context and circumstances.¹⁸

With an expected doctor shortage, the Health Resources and Services Administration for example, increased not only the amount of money to increase doctors' training but also for nurse practitioners and physician assistants to support primary care workforce.¹⁹ There are also calls from organisations, amongst others WHO, that make a number of recommendations regarding expanding the roles of nurses.²⁰ In order to enable policy-makers to make informed decisions about health-care delivery models there is a need for evidence about the quality of care, access and costs associated with care from nurses.

Since our Cochrane review published in 2005²¹ several studies have been conducted, resulting in a stronger evidence base with regard to nurse–doctor substitution. The number of new studies on nurses in primary care show an increasing international interest in task shifting and the shifting of boundaries between medicine and nursing. Moreover, regulatory and educational reforms internationally support the trend towards advancing nursing roles in health care delivery and promoting task-shifting. The growth rate of the nursing workforce is nowadays three times the growth rate for doctors (nine times for nurse practitioners), which provides a great opportunity to meet the increasing demands in primary care.³

Our updated review adds value to the existing recently published systematic reviews by 1) the exclusion of studies which are not solely substitution, resulting in more accurate findings of nurse–doctor substitution and 2) its rigorous methodology according to the Cochrane Handbook. This includes a risk of bias table which is used to assess the methodological quality of individual studies relevant for the overall interpretation of the results. Moreover, additional insight from this updated review is important because some results from other reviews remain inconclusive (e.g. on costs) and primary health services have changed over the years. We appraised and synthesised relevant randomised trials until January 2015, and we conducted a meta-analysis of outcomes where possible.

OBJECTIVES

Our aim was to investigate the impact of nurses working as *substitutes* for primary care doctors on:

- Patient outcomes
- Processes of care
- Utilization, including costs

METHODS

Types of studies

Randomised trials, i.e. trials with random allocation of subjects to intervention and control groups. Controlled before-after studies and non-randomised trials were included in our previous Cochrane review.²¹ Since the amount of available randomised trials, controlled before-after (n=3) and randomised trials (n=3) were excluded from this update. Randomised trials provide more robust evidence on effectiveness, so it is therefore unlikely to be worthwhile to include other study designs where many randomised trials are available.

Types of participants

- *Doctors* - any kind of doctor working in a primary care setting, including general practitioners, family doctors, paediatricians, general internists or geriatricians.
- *Nurses* - any qualified registered nurse working as a substitute to a doctor working in primary care. The definition of a qualified nurse is “a graduate who has been legally authorised (registered) to practice after examination by a state board of nurse examiners or similar regulatory authority”.²⁰ This includes: nurse practitioners, clinical nurse specialists, advanced practice nurses, practice nurses, health visitors, etc. As the job title, education, and experience of nurses varies considerably among and within countries, we did not select nurses by virtue of their job title. Only mental health nurses were excluded as they focus on a small patient group and usually not have the first contact with the patient. Also trainee nurses were excluded as they do not work to their full potential as consequence of their traineeship.
- *Patients* - presenting in primary care with a physical complaint.

The review is limited to primary health care services that provide first contact and ongoing care for patients with all types of physical health problems. It includes family practice, general practice, outpatient settings, and ambulatory primary care settings, excluding accident and emergency in hospitals. Patients presenting at an accident and emergency departments in hospitals are not considered to be comparable with patients presented at primary care services. These departments generally deal with genuine life-threatening emergencies and are therefore not considered to be an alternative to a doctors' appointment in primary care.

Types of interventions

Our focus was on nurses working as substitutes for primary care doctors. Substitution refers to the situation where task(s) formerly performed by one type of professional (i.e. a doctor) are transferred to a different type of professional (i.e. a nurse), usually with the intention of reducing cost or addressing workforce shortages.^{1,8} Substitution studies typically examine the case where a nurse is responsible for providing the same health care as a doctor, and the performance of these two practitioners is compared. For example, a nurse-led clinic for a particular disease or condition is compared to a doctor-led clinic.

Supplementation refers to the situation where a nurse supplements or extends the care of the doctor by providing a new primary care service. The aim is generally to improve the quality of care rather than reduce cost or address workforce shortages. Supplementation studies typically compare usual care by a doctor to an innovative service provided by a nurse working alongside a doctor. For example, a family practice with a nurse-led diabetes clinic is compared to a family practice without such a clinic. This type of study risks confounding two aspects of care provision: a) type of service (specialised clinic vs routine consultation), and b) who provides that service (doctor or nurse). Supplementation studies have been excluded from this review.

Types of outcome measures

Three types of outcomes were considered for this review, patient outcomes, process of care outcomes, utilization outcomes including both volume and costs.

Primary outcomes

Patient outcomes

- Mortality
- Health status (clinical outcomes and self-reported outcomes)
- Satisfaction
- Quality of life
- Other (compliance, knowledge, preference for doctor or nurse)

Secondary outcomes

Process of care outcomes

- Practitioner adherence to clinical guidelines
- Practitioner health care activity (examinations, provision of advice)

Utilization outcomes

Volume

- Frequency and length of consultations
- Number of return visits
- Number of prescriptions
- Number of tests and investigations
- Number of referral to or frequency of use of other services
- Frequency of use of other services

Costs

- Direct health services costs related to volume
- Indirect (societal) costs

Search methods for identification of studies

Electronic searches

We searched the following databases:

- The Cochrane Central Register of Controlled Trials (CENTRAL) 2014, Issue 12, part of the *The Cochrane Library*. www.cochranelibrary.com (searched 20.01.2015)
- MEDLINE In-Process & Other Non-Indexed Citations, MEDLINE Daily, MEDLINE and Ovid OLDMEDLINE 1946 to Present, Ovid (searched 20.01.2015)
- CINAHL 1981 to present, EbscoHost (searched 20.01.2015)

Searching other resources

Grey literature databases

- The Grey Literature Report: <http://www.nyam.org/library/online-resources/grey-literature-report/>; (searched 21.02.2017)

- OpenGrey: <http://www.opengrey.eu/>.(searched 21.02.2017)

Trial Registries

- International Clinical Trials Registry Platform (ICTRP), World Health Organization (WHO) <http://www.who.int/ictcp/en/> (searched 21.02.2017)
- ClinicalTrials.gov, US National Institutes of Health (NIH) <http://clinicaltrials.gov/> (searched 21.02.2017)

We also searched the Science Citation Index and the Social Sciences Citation Index 1975 to present for articles citing relevant studies, Web of Knowledge, Thomson Reuters (searched 27.01.2015) and searched the reference lists of all included papers and relevant reviews identified. See Figure 1 for records retrieved, excluded and included.

Data collection and analysis

Selection of studies

At least two review authors (among ML, NW, KW, EK and AVV) independently screened the search results at three levels: titles; abstracts to assess which studies potentially satisfied the inclusion criteria; and full-text copies of papers that were potentially relevant. If we could not assess the paper for eligibility based on title or abstract, we obtained the full text. Data from research published in duplicate were included only once.

Data extraction and management

A data extraction form based on the standard EPOC checklist was designed for this review. [See www.epoc.uottawa.ca for details] Data from each study were abstracted independently by at least two reviewers (ML, MB, NW, KW, EK and AVV). Differences were resolved by discussion.

If a single publication reported two or more separate studies, then each study was extracted separately. If the findings of a single study were spread across two or more publications, then the publications were extracted as one. Outcomes measured on different time points and presented in different publications, for example 6 months and 2 years after the intervention, were both extracted. The longest follow-up was used in the meta-analyses. For each study with more than one control or comparison

group for the nurse intervention, we report only the results for the control condition in which doctors provided the same intervention as the nurse.

Assessment of risk of bias in included studies

At least two review authors (among ML, MB, NW, KW, EK and AVV) independently assessed the risk of bias of each included study using the criteria suggested by EPOC.²² We assessed randomised trials for generation of allocation sequence, concealment of allocation, similar baseline outcome measurements, similar baseline characteristics, incomplete outcome data, blinding of participants, blinding of outcome assessors, protection against contamination, selective outcome reporting and bias due lack of power. We scored each study for risk of bias as follows: 'low' if all key domains were scored as 'low risk'; 'unclear' if one or two key domains were scored as 'unclear risk'; and 'high' if more than two key domains were scored 'unclear risk' or 'high risk'. When no information was available we scored 'unclear risk'. For similar baseline characteristics and outcome measurements we scored 'low risk' when the baseline values were equal or when there was a correction in the analysis for differences in baseline values. Incomplete outcome data was scored low risk when the follow up was >80% or when the follow up was <80% with equal results with the intention to treat and per protocol analysis. With respect to blinding: when there was no blinding of patients and personnel, we scored 'unclear risk', since we do not know whether not blinding influenced the results. For some objective outcomes, e.g. mortality, blinding does not influence the risk of bias, but for other outcomes in the same study (e.g. satisfaction), it could be that non-blinding does influence the outcomes.

We did not split the different outcomes for assessment of risk of bias within a study, since the judgement of risk of bias was generally equal for all outcomes within a study. If the risk of bias judgement for a particular outcome was divergent, we commented on that.

Assessments of the risk of bias for included studies are shown in the 'Characteristics of included studies' (online available) table and are summarised in Figure 2 and Figure 3. The risk of bias assessments were not used for deciding which studies should be included in the meta-analyses. However, we conducted sensitivity analyses excluding the studies with a high risk of bias. Furthermore, these assessments were used in interpreting the results and, particularly, in assessing the certainty of evidence for doctor-nurse substitution.

Measures of treatment effect

The measure of effect size of the continuous outcomes patient satisfaction, disease activity score, pain and length of consultation was the *standardised mean difference (SMD)*. The SMD is more appropriate than the *mean difference (MD)* in situations where the measurement instrument (i.e. the patient satisfaction scale) differed between studies. [See Cochrane Reviewer's Handbook version 5.1.0]. MDs were used for the patient outcomes; blood pressure, cholesterol and HbA1c.

The measure of effect size used for the dichotomous outcomes was the *relative risk (RR)*. [See Cochrane Reviewer's Handbook version 5.1.0] Odds ratios were converted to RRs, by using the built-in calculator in RevMan.

Unit of analyses issues

We included cluster-randomised trials in the meta-analyses along with individually randomised trials. In the meta-analyses we included one cluster-randomised trial that accounted for clustering in the analyses (Campbell 2013²³). The small cluster-randomised trials which did not correct for clustering (Chambers 1978²⁴; Moher 2001²⁵; Spitzer 1973²⁶) were also included in the meta-analyses, however excluded in the sensitivity analysis.

Dealing with missing data

For missing or unclear information, we contacted the study investigators for clarification or additional information. For studies that reported continuous data but did not report standard deviations, we either calculated these from other available data such as standard errors, or imputed these using the methods suggested in Higgins 2001²⁷.

We extracted data from the ITT analysis where possible. If ITT data were not present, we excluded the study from the meta-analyses in the sensitivity analysis.

Assessment of heterogeneity

Clinical, country context, setting and methodological diversity: we first made a qualitative assessment of the extent to which the studies assessing a particular comparison were similar to one another. This included an assessment of the clinical settings, countries, settings and type of measurement scales to determine whether meta-analysis was appropriate.

Statistical heterogeneity: we obtained an initial visual overview of statistical heterogeneity through scrutinising the forest plots, looking at the overlap between confidence intervals around the estimate for each included study. In addition we used the I^2 statistics and its confidence intervals to estimate and quantify heterogeneity.

Assessment of reporting biases

To reduce possible publication bias, we employed strategies to search for and include relevant unpublished studies. These strategies included searching the grey literature and prospective trial registration databases to overcome time-lag bias.

We used funnel plots for outcomes with more than four studies to visualise whether there was asymmetry. None of them showed asymmetry. However, there were too few studies to reliably assess funnel plot asymmetry, visually or quantitatively.

Data synthesis

To summarize the effectiveness of the doctor-nurse substitution, several meta-analyses were performed. The statistical meta-analyses were conducted using the RevMan software distributed by the Cochrane Collaboration. For studies in which the quantitative data were absent or insufficient to make the calculation, we reproduced the data as presented in the additional tables. A meta-analysis was performed if the nature of the outcome was similar. Adjusted RRs were used if available in the article. When not available, we calculated RRs from events. For categorical outcomes, we calculated log relative risks (RR) and standard errors (SE) of the log RR for both individual and cluster randomised trials. We analysed the log RRs for individual randomised trials and the adjusted log RRs for cluster randomised trials together. RRs were preferred over ORs since the interpretation is intuitive. When no cluster randomised trials were included in the meta analysis, we used RRs instead of the log RRs.

We used a random-effects meta-analysis, which is known to be more conservative and more suitable in the presence of any heterogeneity.²⁸ Although we expect substantial heterogeneity in some cases, which can be attributed to differences in the population, intervention, comparators, outcomes and settings, the detection of existing heterogeneity can be problematic when meta-analysing a small number of studies.²⁸ Therefore, for more transparency we report the 95% confidence intervals of the I^2 statistic, obtained under an inverse variance DerSimonian-Laird random-effects model

for continuous outcomes, and a Mantel-Haenszel / DerSimonian-Laird random-effects model hybrid for dichotomous outcomes.

Summarising and interpreting results

We used the GRADE approach to assess the certainty of evidence related to each of the key outcomes.²⁹ We used the GRADE profiler, to import data from Review Manager 5 and create a 'Summary of findings' table.

For assessments of the overall certainty of evidence for each outcome that included pooled data from randomised trials only, we downgraded the evidence from 'high certainty' by one level for serious (or by two for very serious) study limitations (risk of bias), indirectness of evidence, serious inconsistency, imprecision of effect estimates or potential publication bias.

We used these assessments, along with the evidence for absolute benefit or harm of the interventions and the sum of available data on all critical and important outcomes from each study included for each comparison, to draw conclusions about the effectiveness of nurse-led care in primary care. 'Summary of findings' table consisted of critically important clinical and functional outcomes identified in the selected trials.

When judging the importance of SMDs, we acknowledged that 0.2 represents a slight effect, 0.5 a moderate effect, and 0.8 a significant effect.²⁷

Subgroup analysis and investigation of heterogeneity

During the review process, we identified several factors that might explain heterogeneity. These included: nurse title (i.e. nurse, registered nurse, nurse practitioner, specialized nurse); characteristics of the intervention and comparator (i.e. total substitution, partial substitution); study size; duration of follow- up; type of care (i.e. single contact, series, urgent care), range of patient complaints (i.e. all patients or particular patient groups) and setting. These were undertaken as exploratory, hypothesis generating analyses since these factors were not identified a priori and a number of potential explanatory factors were considered. We did consider a subgroup analysis for nurse title as other systematic reviews did.¹⁴ However, since we have little information about exact role definitions and educational levels from nurses in the different trials and we know that job titles differ among countries, we decided that it is impossible to create clear and valid subgroups in order to perform subgroup analyses.

Sensitivity analysis

We performed sensitivity analyses by excluding trials assessed as high risk of bias (overall) (Chambers 1978²⁴; Lewis 1967³⁰; Hemani 1999³¹; Mundinger 2000³²), cluster randomised trials (Chambers 1978²⁴; Moher 2001²⁵; Spitzer 1973²⁶), trials presenting per protocol (PP) data instead of intention-to-treat (ITT) data when follow-up is < 80% (Chambers 1978²⁴; Mundinger 2000³²; Venning 2000³³), trials from low-income countries (Sanne 2010³⁴) and trials where the RR was been calculated from an OR (Iglesias 2013³⁵). All sensitivity analyses were performed on all outcomes.

RESULTS

Description of studies

Results of the search

We identified a total of 4831 articles from the electronic and supplementary searches. We excluded 4744 articles following a review of title and abstracts and retrieved and assessed the full text of 87 articles. We excluded 78 full text articles that investigated the role of nurses working as supplements to primary care doctors and excluded one additional study which was mixed primary and hospital care. Nine randomised trials met the inclusion criteria and were included in this update (see Figure 1).

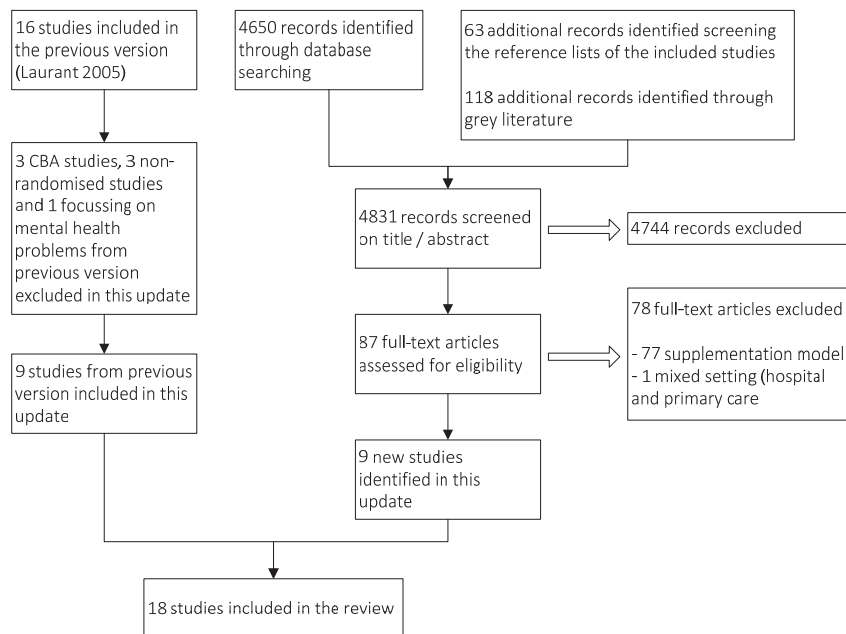
Included studies

We included nine new randomised trials in this update (Chan 2009³⁶; Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Sanne 2010³⁴; Voogdt-Pruis 2010³⁹; Campbell 2013²³; Iglesias 2013³⁵; Ndosi 2013⁴⁰; Larsson 2014⁴¹). The review now includes 18 randomised trials in which nurses work as doctors' substitutes. Four of them are cluster-randomised trials (Campbell 2013²³; Chambers 1978²⁴; Moher 2001²⁵; Spitzer 1973²⁶) and randomised by practice (Campbell 2013²³; Moher 2001²⁵) or families (Chambers 1978²⁴; Spitzer 1973²⁶). The findings of the included studies are described below and are summarised in Table 1.

Setting

Six studies were conducted in the UK (Campbell 2013²³; Chan 2009³⁶; Lattimer 1998⁴²; Moher 2001²⁵; Ndosi 2013⁴⁰; Shum 2000⁴³), three studies were conducted in the Netherlands (Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Voogdt-Pruis 2010³⁹), three studies in USA (Hemani 1999³¹; Lewis 1967³⁰; Mundinger 2000³²), three in Canada

Figure 1. Study flow diagram



(Chambers 1978²⁴; Spitzer 1973²⁶; Venning 2000³³), one in Sweden (Larsson 2014⁴¹), one in Spain (Iglesias 2013³⁵) and one in South Africa (Sanne 2010³⁴).

Nurses worked as doctor substitutes in a range of care settings. The interventions were carried-out in general practices/ family practices (Campbell 2013²³; Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Iglesias 2013³⁵; Shum 2000⁴³; Spitzer 1973²⁶; Voogdt-Pruis 2010³⁹; Chambers 1978²⁴) (outpatient) nurse clinics (Chan 2009³⁶; Lewis 1967³⁰; Larsson 2014⁴¹; Ndosi 2013⁴⁰) and in specialised practices (Hemani 1999³¹).

The study period varied from 2 weeks (Venning 2000³³) to 48 months with a mean of 14 months (SD 12 months). For one study, the study period is unknown (Houweling 2011³⁸).

Role of the nurse

In five studies the nurse assumed responsibility for first contact and ongoing care for all presenting patients (Chambers 1978²⁴; Hemani 1999³¹; Mundinger 2000³²; Spitzer 1973²⁶; Iglesias 2013³⁵).

In five studies the nurse assumed responsibility for first contact care for patients wanting (urgent) consultations during routine practice hours (Dierick-van Daele 2009; Shum 2000; Venning 2000; Campbell 2013²³) or out-of-hours (Lattimer 1998⁴²).

In seven studies the nurse had responsibility for the ongoing management or follow-up of patients with a particular chronic diseases (Chan 2009³⁶; Lewis 1967³⁰; Moher 2001²⁵; Sanne 2010³⁴; Houweling 2011³⁸; Larsson 2014⁴¹; Ndosi 2013⁴⁰).

In one study the nurse provided mainly health education or preventive services to a specific group of patients (Voogdt-Pruis 2010³⁹).

Table 1. Characteristics of included studies

<i>Campbell 2013²³</i>
<p>Methods: RCT</p> <p>Participants: 13707 patients (total group); mean age in intervention group 41.5(25.2), in control group 44.7(25.0); 40% male in intervention group, 41% male in control group. 42 practices in 4 centres</p> <p>Interventions: nurse-led computer supported telephone triage versus GP-led telephone triage</p> <p><i>Detailed description intervention:</i></p> <p>Comparison of three groups delivering telephone triage: GP-led triage, nurse-led computer based triage, or usual</p> <ul style="list-style-type: none"> - GP-led: Components of the Stour Access System were used. Once the receptionist had established that the patient was requesting a same-day appointment, the patient was asked to leave a contact number with the receptionist and was advised that the GP will call them back within around 1 to 2 hours. This timescale (for both the GP-led and nurse-led arm) was flexible, so as to optimise prioritisation. The GP discussed the complaint with the patient and triaged them to the most appropriate person, such as a nurse, or booked a face-to-face appointment with the GP, or provided advice on the telephone. - Nurse-led: The Plain Healthcare Odyssey Patient Assess was used for patients registered at their practice. A computerised clinical decision support (CCDS) system was used to assist nurses at the practice in assessing and making decisions about the clinical needs of patients who have called their practice requesting a same-day appointment. - Usual care: The standard consultation management systems practices used (differed between practices) <p><i>Supervision, oversight:</i> unknown</p> <p>Outcomes</p> <p><i>Patient outcomes:</i></p> <ul style="list-style-type: none"> - participants’ experience of care after the same-day request - problem resolution - overall satisfaction with care provided on the day of the consultation request - health status (EQ-5D) - deaths associated with trial processes <p><i>Process of care measures:</i></p> <ul style="list-style-type: none"> - Primary care workload (total numbers of primary care contacts taking place in the 28 days after the patient’s index appointment request) - occurrences of each of the 20 individual consultation types contributing to the primary outcome - the profile of patient contacts and their distribution by health professionals - patient safety (i.e.; the occurrence and duration of any emergency hospital admissions within 7 days

of the index request, and the number of patients with any attendances to accident and emergency departments within 28 days)

Resource utilization:

Costs: Costs over 28 days with regard to the primary outcome contacts

Notes

Country: United Kingdom

Study period: 25 months

Nurse role: Nurse in charge of computer-supported telephone triage for patients requesting a same day appointment.

Nurse title: Nurse (nurse practitioners and practice nurses)

Nurse educational background: EQF level unknown

Nurse years of experience: unknown

Nurse additional training: Training in the use of Odyssey Patient Assess and in telephone consultation skills. Following this there was a pre-trial period of one month during which they were expected to practise using the decision support in their daily work and, towards the end of this period, their use of the system was assessed.

Chambers 1978²⁴

Methods: RCT

Participants: 868 patients (total group), all ages, 34% male; 1 nurse, 1 doctor

Interventions: families allocated to nurse-led primary care vs families allocated to doctor-led primary care

Detailed description intervention:

Comparison of two groups providing family care:

- A conventional groups, assigned to continuing primary clinical services from a family physician
- A family practice nurse group whose first-contact primary clinical services were to be provided by the family practice nurse

Supervision, oversight: The family practice nurse was delegated the responsibility of choosing between three possible courses of action: providing specific treatment; providing reassurance alone, without specific treatment; or referring the patient to the associated family physician, to another clinician or to an appropriate service agency

Outcomes

Patient outcomes:

- Health status

Notes

Country: Canada

Study period: 12 months

Nurse role: First contact and ongoing primary care

Nurse title: Practice nurse

Nurse educational background: EQF level unknown

Nurse years of experience: The nurse already worked for 4 years in the family practice.

Nurse additional training: The nurse attended a special 9-month education programme for family practice nurses including decision-making, clinical judgement, social history taking, physical examinations and the ability to distinguish between abnormal and normal patient symptoms and signs as skills.

Chan 2009³⁶

Methods: RCT

Participants: 175 patients (total group), mean age 48.4 years (control), 50.2 years (intervention), 49% male (in total).

1 nurse and unknown number of doctors.

Interventions: patient care after gastri-endoscopy allocated to nurse vs. patient care after gastri-

endoscopy allocated to doctor

Detailed description intervention:

Comparison of two groups providing follow-up for patients with dyspepsia after direct access gastroscopy.

- Systematic GNP-led follow-up in an outpatient clinic : The 'GNP' group was given one out-patient appointment a full medical history was taken
- Usual care by GPs: The 'GP' cohort was discharged and advised to see their GP

Patients included were those with mild gastro-esophageal reflux disease (GORD –non-erosive or grade A and B oesophagitis, hiatus hernia), non-ulcer dyspepsia (NUD) (mild and moderate gastritis or duodenitis) and those with normal findings. After gastroscopy, endoscopists maintained their routine practice in giving verbal and written advice to patients and documented treatment recommendation to GPs in a formal report. The clinical management was structured, based on national and local guidelines, with reference to each patient's predominant symptoms. Patients were given counselling and lifestyle advice, supplemented with relevant locally devised leaflets i.e. reflux, non-ulcer dyspepsia, weight control, and an individualised treatment plan agreed with them. Further investigation such as the urea breath test, motility studies and barium meal were initiated if required, as per routine clinical practice. To ensure practice consistency and reproducibility, 'history taking' and 'lifestyle advice' proformas were devised and used.

Supervision, oversight: Studied interventional patients were seen in the nurse-led clinic within secondary care, without direct supervision from any consultant gastroenterologists. However, cases could be discussed with a doctor, if I deemed it necessary

Outcomes

Patient outcomes:

- Gladys, health status short form (SF-12)

Notes

Country: United Kingdom

Study period: 6 months

Nurse role: Ongoing care (follow-up) after gastro-endoscopy

Nurse title: Gastro-intestinal Nurse Practitioner

Nurse educational background: EQF level 8

Nurse years of experience: The nurse had been qualified as a State Registered Nurse for 20 years and specialised in Gastro nursing for 4 years and 2 months

Nurse additional training: The clinic consultation skill was developed with the help of a named GI consultant. Initially, the nurse sat in that clinics (2 months) as an observer. The next stage was to see patients who had been filtered by the consultant from that clinic on the day. The nurses' consulting room was next to the GI consultants' to effect direct supervision, as each patient case was presented to him and treatment identified (6 months). Finally, a Nurse-led clinic was established formally running alongside the GI clinics, with pre-identified patients in advanced from all GI consultants. Some 18 months later the nurse was authorised to discuss selective cases with the patient's named consultant, if required. There were 3 monthly reviews initially, reduced to yearly, incorporated in the annual appraisal.

Dierick-van Daele 2009³⁷ (including secondary studies⁴⁴)

Methods: RCT

Participants: 1501 patients (total group); mean age in intervention group 46.1, in control group 42.8; 38.2% male in intervention group, 40% male in control group. 50 GPs, 12 NPs

Interventions: patients allocated to nurse practitioners vs. patients allocated to GPs.

Detailed description intervention: Comparing two groups providing care to patients with common complaints as first point of contact. The NP saw patients with respiratory and throat problems, ear and nose problems, musculoskeletal problems and injuries, skin injuries, urinary problems, gynaecological problems and geriatric problems. The role of the NP involved assessing symptoms including physical examinations where appropriate, diagnosing and making decisions about further treatment, including writing prescriptions, referrals to primary or secondary services and clinical investigations.

Supervision, oversight: The NP had no full authority to prescribe medications and so the GP was always available for consultation and to validate prescriptions and referrals.

Outcomes

Patient outcomes:

- satisfaction
- burden of illness
- Quality of life

Process of care measures:

- adherence to clinical guidelines
- appropriate medication prescribed

Resource utilization:

- prescriptions
- investigations
- return visits

Costs: direct health care costs, including and excluding productivity

Notes

Country: The Netherlands

Study period: 6 months

Nurse role: First contact and ongoing care

Nurse title: Nurse practitioners

Nurse educational background: EQF level 7

Nurse years of experience: 0 years as an NP, at least 2 years of experience as a registered nurse

Nurse additional training: Unknown

Hemani 1999³¹

Methods: RCT

Participants: 450 patients (total group), mean age 61 years, 98% male, 9 nurses, 45 doctors

Interventions: patients allocated to nurse-led primary care vs. patients allocated to trainee doctors (2nd ,3rd year residents) vs. patients allocated to fully trained doctors (attending physicians)

Detailed description intervention: Not available

Supervision, oversight: First-year residents and newly graduated nurse practitioners were required to present every patient to the attending physicians during the first 6 months of their appointment, whereas the remainder of the residents and nurse practitioners presented cases only when they believed it to be necessary.

Outcomes

Resource utilization:

- consultation rate
- tests
- use of other services-hospital admission, emergency room visits, specialty visits

Notes

Country: United States

Study period: 12 months

Nurse role: First contact and ongoing primary care

Nurse title: Nurse practitioners

Nurse educational background: EQF level unknown

Nurse years of experience: unknown

Nurse additional training: unknown

Houweling 2011³⁸

Methods: RCT

Participants: 239 patients (total group); mean age in intervention group 67.1 (11.0), in control group 69.5

(10.6); 52.9% male in intervention group, 42.3% male in control group. 5 doctors (GPs). 2 nurses

Interventions: patients with T2DM allocated to nurse practitioners vs. patients with T2DM allocated to GPs.

Detailed description intervention: Comparing two groups providing diabetes care. Eligible patients were selected using the GPs' patient information system and the local pharmacy. The initial selection included patients with a diagnosis of diabetes, patients who were on medication for diabetes and patients whose glycated haemoglobin (HbA1c) levels had been measured in the last three years. The exclusion criteria included (1) no diagnosis of diabetes, (2) type 1 diabetes, (3) diabetes not being treated in the primary health care setting, (4) the inability to participate in the study because of old age or comorbidity, in the opinion of the GP and (5) not being willing to return for follow-up. PNs were permitted to prescribe 14 different medications and to adjust dosages for a further 30. They were also allowed to order laboratory tests. The PNs were specifically not permitted to prescribe insulin, but were able to adjust the dosage.

Supervision, oversight: The PNs worked with an protocol published in 'protocollaire diabeteszorg'. The protocol indicated when the PN had to consult the GP. In case the patient showed specific complains during consultation, the patients would be referred to the GP.

Outcomes

Patient outcomes:

- HbA1c, bp, chol, chol/hdl. glycaemic control
- blood pressure
- lipid profile
- HRQOL
- diabetes-related symptoms
- patients' satisfaction

Process of care measures:

- referred to an ophthalmologist after not having visited one for the last two years, in whom measures were taken for feet at-risk
- referred to an internist for starting insulin therapy, whose diabetic, antihypertensive and/or lipid lowering drugs had been intensified

Resource utilization:

- health care consumption (number of patient visits, number of contacts between PNs and GP)

Notes

Country: The Netherlands

Study period: unknown

Nurse role: Ongoing care for patients with diabetes type 2 in a primary care setting.

Nurse title: Practice nurse

Nurse educational background: EQF level 5

Nurse years of experience: Two PNs, experienced in working as a nurse, however no prior experience working in general practice.

Nurse additional training: At the beginning of the trial, the PNs received one week of training on a detailed treatment and management protocol aimed at optimising glucose, blood pressure and lipid profile regulation and eye and foot care in patients with diabetes. The training aimed to educate the PNs to a level comparable to the level of a GP, so they would be able to provide diabetes care without supervision.

Iglesias 2013³⁵

Methods: RCT

Participants: 1461 patients (total group), 708 control, 753 intervention; mean age in intervention group 39.0 (15.1), in control group 38.6(14.5). 39.0% male in intervention group, 38.8% male in control group. 142 GPs. 155 nurses

Interventions: care delivered by nurses to patients asking same day appointment vs. usual care delivered by GPs to patients asking same day appointment

Detailed description intervention: Compare the effectiveness of care delivered by nurses to the usual care delivered by GPs, in adult patients asking to be seen on the same day in primary care practices.

Patients assigned to the intervention group were seen by trained nurses who followed the guideline developed during the study's preparation phase. The nurses had access to an electronic application which included the guideline, designed as a decision-making support tool. Patients assigned to the control group were seen by the GP, who followed the usual procedures established in the practice and did not have access to any kind of decision-making support tools

Supervision, oversight: unknown

Outcomes

Patient outcomes:

- resolution of symptoms
- patient satisfaction
- patient perception of the quality of the information and care received
- patient preference

Process of care measures:

- Resolution by nurse
- duration of the visit

Resource utilization:

- drug prescriptions
- sick leave
- re-visit in primary care for the same reason during the following 2 weeks
- admission to hospital for the same reason

Notes

Country: Spain

Study period: 5 months

Nurse role: Nurses trained to respond low complexity, acute pathologies

Nurse title: nurse

Nurse educational background: EQF level unknown

Nurse years of experience: unknown

Nurse additional training: unknown

Larsson 2014⁴¹ (including secondary studies⁴⁵)

Methods: RCT

Participants: 107 patients (total group). Mean age in intervention group 55.0 (12.3), in control group 55.8(13.2). 45.0% male in intervention group, 44% male in control group. 5 nurses. Unknown number of rheumatologists.

Interventions: patients monitored by a nurse followed by monitoring by a rheumatologist vs. patients monitored by a rheumatologist

Detailed description intervention: Compare and evaluate treatment outcomes of a nurse-led rheumatology clinic and a rheumatologist-led clinic in patients with low disease activity or in remission undergoing biological therapy. The intention was to replace one of the two annual rheumatologist monitoring visits by a nurse-led rheumatology monitoring visit in patients undergoing biological therapy

- Rheumatologist-led clinic: patients with CIA undergoing biological therapy is monitoring by a rheumatologist every 6 months for 30 minutes to evaluate the effect of the medication and the disease activity measured by the. The rheumatologist assessed disease activity by examining tender and swollen joints based on a 28-joint count in addition to evaluating the results of laboratory tests.
- Nurse-led rheumatology clinic: Patients were monitored for 30 minutes by a rheumatology nurse after 6 months, followed by 30 minutes monitoring by a rheumatologist after 12 months. The nurse assessed the patients' disease activity by examining tender and swollen joints based on the 28-joint count in addition to evaluating the results of laboratory tests in the same way as a rheumatologist. Drug treatment was discussed in terms of administration, adherence, side effects and laboratory tests as well as patients' global health

Supervision, oversight: If necessary, the nurse could contact the rheumatologist for advice or to obtain a prescription.

Outcomes

Patient outcomes:

- disease activity
- perceived global health the previous week
- physical difficulties in performing activities of daily living
- pain
- satisfaction with and confidence in obtaining rheumatology care
- medication record
- employment status
- adverse events

Resource utilization:

- cortisone injections in addition to regular rheumatologist monitoring visits
- blood tests
- radiography
- pharmacological therapy
- additional telephone calls to a rheumatology nurse
- additional telephone calls to a rheumatologist
- additional rheumatologist visits
- team rehabilitation in inpatient settings
- team rehabilitation in outpatient settings
- occupational therapist treatments
- psychosocial treatments
- specialist consultations

Costs: Total annual rheumatology care per patient

Notes

Country: Sweden

Study period: 22 months

Nurse role: nurse-led rheumatology monitoring visit in patients undergoing biological therapy

Nurse title: Registered nurse

Nurse educational background: EQF level 6

Nurse years of experience: 22–39 years' professional experience and 9–20 years' experience of managing rheumatic diseases in both inpatient and outpatient rheumatology care

Nurse additional training: The nurses had undergone special training from a rheumatologist and RA instructors to assess swollen and tender joints based on the 28-joint count to make an evidence-based assessment of disease activity.

1. Theoretical lecture about the anatomy of the joint with pictures and about joint examination technics – inspection, palpation, assessing range of motion and function for half an hour.
2. Practical examination of the hand and wrist
3. The nurses were trained in groups of 2-3 by a RA-instructor (patient partner), who have RA themselves and well educated. Time: 1,5 hours.
4. Same procedure, but now foot and ankle. Time 1.5 hours.
5. All nurses also got a booklet about hand- and wrist examination, and one about foot- and ankle examination, for self-studying and training.
6. One week later another 1.5 hours lecture to repeat both hand- and foot examinations in the same groups.
7. Rheumatologist meets the whole group of nurses and gives a lecture on how to examine the big joints, shoulder, elbow, knee and hip. The nurses examined an RA patient and then practiced on each other. Time. 1.5 hours.

Time to ask the rheumatologist afterwards if needed, and also to watch the rheumatologist examining other patients in her practice.

Lattimer 1998⁴² (including secondary studies⁴⁶⁻⁴⁸)

Methods: RCT

Participants: 10134 patients (total group), all ages, 48% male. 6 nurses. 55 doctors

Interventions: Nurse call management during out-of-hours vs. GP call management during out-of-hours

Detailed description intervention: Comparison of two groups answering incoming phone calls with for patients during out-of-hours.

Nurse telephone consultation:

In the intervention arm of the trial, all calls were passed straight to the nurse except in the case of immediate referral to the ambulance service by the receptionist. The nurse then undertook a systematic assessment of the caller's problem and recommended an appropriate course of action. The nurse was aided by TAS (telephone advice system), a computer based primary care call management system. Triage nurses were able to complete calls without onward referral. The call management options for the nurses were:

- Telephone advice
 - on home management of the problem
 - to see the patient's own GP the next day
 - to attend the Accident and Emergency Department
- Referral of the patient to the GP on duty
 - inviting the patient to attend the primary care centre
 - advising the caller that the GP would contact them by telephone
 - Contacting the 999 ambulance service plus referral to the GP on duty
 - Referral to another agency (e.g. on call Community Psychiatric Nurse) plus referral to the GP on duty.

At the time of the study, the triage nurses were seen to be acting as 'competent agents' of the GP. They had personal professional responsibility to ensure that they had been adequately prepared for the role and were accountable for their own actions. The GP could delegate care, but not the accountability for that care.

Doctor telephone consultation:

Incoming phone calls were answered by a receptionist who passed the message to a doctor

The call management options for the GP were:

- Telephone advice
 - on home management of the problem
 - to see the patient's own GP the next day
 - to bring the patient to be examined at the primary care centre
 - to take the patient to the Accident and Emergency Department
- Examination of the patient at their home or in the primary care centre with
 - advice on home management
 - advice to see the patients own GP the next day
 - treatment
 - admission to hospital

Supervision, oversight: Nurses would refer calls to a GP if in doubt about how best to manage a situation, or would discuss a patient with them (in person at the centre or over the telephone). Before the end of every shift the triage nurses contacted the general practitioners on duty to report back on all the calls they had managed. Formal, monthly professional supervision was provided by the trial project nurse.

Outcomes

Patient outcomes:

- mortality

Resource utilization:

- physician workload
- hospital referral and admission
- emergency room visits
- direct costs

Notes

Country: United Kingdom

Study period: 3-7 days

Nurse role: First contact care for patients with urgent problems out-of-hours

Nurse title: Not clear

Nurse educational background: EQD level 6

Nurse years of experience: The nurses were required to have a minimum of five years post registration experience, including experience in primary health care.

Nurse additional training: A six week education programme to prepare nurses for a 3 month probationary period of supervised telephone triage practice. The taught component covered clinical skills (management of adult and child health problems and related pharmacology); telephone consultation (including professional and medico-legal aspects, communication and interpersonal skills at different phases of the telephone encounter; assessment and decision making skills in telephone triage; approaches to managing a variety of situations on the telephone including 'difficult' calls using scenarios; skills in using the TAS system; patient perspectives). Programme contributors were largely drawn from clinical GPs involved in the trial and academic staff. The programme comprised approximately 40 hours in total with 20hrs taught over 6 weeks and 20 hrs individual practical work and assessment.

Lewis 1967³⁰

Methods: RCT

Participants: 66 patients (total group), 16+ years, 12% male. Unknown number of nurses and doctors

Interventions: patients allocated to nurse-led care vs. patients allocated to doctor-led care

Detailed description intervention: Comparing two groups delivering care to patients with chronic illnesses

- Nurse clinic: Nurses as the primary source care for adults with chronic illnesses (i.e. hypertensive cardiovascular disease; arteriosclerotic heart disease; exogenous obesity; psychophysiologic reactions; and arthritis)
- Control: medicine clinic

Supervision, oversight: unknown

Outcomes

Patient outcomes:

- health status
- provider preference
- compliance with follow-up attendance

Resource utilization:

- direct costs

Notes

Country: United States

Study period: 12 months

Nurse role: Ongoing primary care for patients with stable chronic disease

Nurse title: Not clear

Nurse educational background: EQF level unknown

Nurse years of experience: unknown

Nurse additional training: unknown

Moher 2001²⁵

Methods: RCT

Participants: 1347 patients (total group), mean age 66 years, 69% male. Unknown number of nurses and doctors in 21 practices

Interventions: patients with coronary heart disease allocated to nurse-led follow-up vs. patients with coronary heart disease allocated to doctor-led follow-up.

Detailed description intervention: Comparison of three different interventions for improving the secondary preventive care of patients with coronary heart disease delivered at the level of general practice: audit and feedback; recall to a general practitioner; and recall to a nurse clinic.

- Audit and feedback (audit group)—Practices were given summary audit results at a practice meeting

(one practice requested written material only). The results presented were the number of patients with myocardial infarction, angina, and revascularisation; the prevalence of identified coronary heart disease in the practice; and the proportions of patients with “adequate assessment” and treatment with antiplatelet drugs, hypotensive agents, and lipid lowering drugs. Anonymised data from other practices in the study were given for comparison. Practices were asked to provide usual care and were given no further support during the trial.

- Recall to general practitioner (GP recall group)—Practices were given the same patient information as was given to the audit group but were also given the names of patients identified as having coronary heart disease. The guidelines for secondary prevention were discussed and agreed with the practice doctors and gave ongoing support in setting up a register and recall system for regular review of patients with coronary heart disease by their general practitioner.
- Recall to nurse clinic (nurse recall group)—Practices were given the same patient information as was given to the GP recall group. The trial's nurse facilitator gave ongoing support to the practices in setting up a register and recall system for systematic review of patients with coronary heart disease in a nurse-led clinic. After discussion and agreement of guidelines for secondary prevention, the practice doctors and nurses agreed the clinic protocol, and the nurses received education to implement it.

Supervision, oversight: unknown

Outcomes

Patient outcomes:

- cardiovascular risk factors

Process of care measures:

- adherence to guidelines

Resource utilization:

- prescriptions

Notes

Country: United Kingdom

Study period: 18 months

Nurse role: Ongoing primary care for patients with coronary heart disease

Nurse title: Practice nurse

Nurse educational background: EQF level unknown

Nurse years of experience: unknown

Nurse additional training: the nurses received education to implement the clinic protocol

Mundinger 2000³² (including secondary studies ⁴⁹⁻⁵¹)

Methods: RCT

Participants: 1316 patients (total group), mean age 44.5 years, 25.5% male. 7 nurses. 17 doctors

Interventions: patients allocated to nurse-led care vs. patients allocated to doctor-led care

Detailed description intervention: Compare NPs and doctors as primary care providers within a conventional medical care framework in the same medical center, where all other elements of care were identical. NPs provided all ambulatory primary care, including 24-hour call and made independent decisions for referrals to specialists and hospitalizations.

The NP and physicians had the same authority to prescribe, consult, refer and admit patients. Furthermore, they used the same pool of specialists, inpatient units, and emergency departments.

Supervision, oversight: MD supervision of the NP's was consistent with New York state and hospital regulations: In New York State NP's have a written agreement with an MD that states the MD will meet with the NP once or twice a year to review any practice issues, or discuss certain cases. there is no on site or regular "supervision". In terms of hospitals in NYS, an MD must sign off on every hospital admission within 24 hrs of admission, but this still allows an NP with privileges to independently admit and care for a patient.

Outcomes

Patient outcomes:

- health status
- satisfaction

Process of care measures:

- care provided by providers

Resource utilization:

- consultation rate
- use of other services -hospital admissions, emergency room visits, specialty visits

Notes

Country: United States

Study period: 2 years

Nurse role: First contact and ongoing primary care

Nurse title: Nurse practitioners

Nurse educational background: EQF level 7

Nurse years of experience: Average of 8-10 years of experience for the NP's in the study

Nurse additional training: additional training was from MD's in hospital based activities, how to admit and bring necessary resources to the patient (specialists, radiology, lab work, etc) and additional training in interpreting tests and conducting ER evaluations.

Ndosi 2013⁴⁰

Methods: RCT

Participants: 181 patients (total group), 91 intervention group, 90 control group); mean age in intervention group 60.2(11.3) in control group 57.3(12.2); 26.5% male in intervention group, 25.7% male in control group. 9 nurses. 10 doctors (rheumatologists).

Interventions: RA patients allocated to nurse-led care vs. RA patients allocated to rheumatologist care.

Detailed description intervention: Two groups were compared providing care to patients with a positive diagnosis of RA

- nurse-led care: included allocated 30-min time slots in which the nurse takes history, performs physical examination, pain control, prescribing or recommending medication and dosage changes, intra-articular or intramuscular steroid injections, provision of patient education, psychosocial support and ordering blood tests or X-rays. Referrals for ward admission, to the rheumatologist or other health professionals, were carried out as appropriate.
- rheumatologist care: the usual RLC is similar to the above except that it usually involves an allocated 15-min time slot.

Supervision, oversight: The rheumatology nurse-led clinics were autonomous but were conducted alongside rheumatologist-led clinics; therefore a rheumatologist was available on site and could be consulted.

Outcomes

Patient outcomes:

- DAS 28
- pain
- fatigue
- duration of morning stiffness
- quality of life
- disability
- hospital anxiety
- depression
- arthritis self-efficacy
- satisfaction

Resource utilization:

Costs: EQ5D, costs applied to units of resource use

Notes

Country: United Kingdom

Study period: 4 years

Nurse role: Ongoing care for patients with rheumatology arthritis

Nurse title: clinical nurse specialist

Nurse educational background: EQF level 7

Nurse years of experience: The nurse had a median experience of 10 years in their current post. And had experience in running nurse-led clinics

Nurse additional training: none

Sanne 2010³⁴

Methods: RCT

Participants: 812 patients (total group), gender unknown. 4 nurses. 4 medical officers.

Interventions: HIV patients allocated to nurses vs. HIV patients allocated to medical officers

Detailed description intervention: Comparing nurse- vs. doctor-monitored HIV care. All patients were managed under South African National Guidelines for HIV treatment and were given standard ART regimens

Supervision, oversight: unknown

Outcomes

Patient outcomes:

- mortality
- failure (virological failure, toxicity failure, study losses)
- satisfaction

Notes

Country: South Africa

Time period: 47 months

Nurse role: Primary health care nurses

Nurse type: Primary health care nurses

Nurse educational background: EQF level unknown

Nurse years of experience: unknown

Nurse additional training: unknown

Shum 2000⁴³

Methods: RCT

Participants: 1815 patients (total group), mean age 27.5 years, 40% male. 5 nurses. 19 doctors

Interventions: patients allocated to nurse vs. patients allocated to doctor

Detailed description intervention: Compare the acceptability and effectiveness of a practice based minor illness service led by nurses with the routine care offered by general practitioners. Nurses managed the patient's care and took the history, performed a physical examination, offered advice and treatment, issued prescriptions (which required a doctor's signature), and referred the patient to the doctor when appropriate.

Supervision, oversight: Patients seen by a nurse were referred to a general practitioner when appropriate.

Outcomes

Patient outcomes:

- health status
- satisfaction
- provider preference

Process of care measures:

- provision of information

Resource utilization:

- length of consultation
- return visits

- prescriptions
- emergency room visits
- use of out-of-hour services

Notes

Country: United Kingdom

Study period: 2 weeks

Nurse role: First contact care for patients with urgent problems

Nurse title: Practice nurse

Nurse educational background: EQF level unknown

Nurse years of experience: an average of 8.4 (3.8) years of experience in practice nursing

Nurse additional training: three month academically accredited degree level course on managing minor illnesses. Nurses attended one half day a week of formal group teaching by a nurse practitioner and were taught twice a week by general practitioners during routine surgeries in the practice where the nurse worked.

Spitzer 1973²⁶ (including secondary studies⁵²⁻⁵⁵)

Methods: RCT

Participants: 4325 patients (total group), all ages, 42.5% male. 2 nurses. 2 doctors

Interventions: families allocated to nurse vs. families allocated to doctor

Detailed description intervention: not available

Supervision, oversight: unknown

Outcomes

Patient outcomes:

- health status;
- satisfaction,
- provider preference

Process of care measures:

- standards of care

Resource utilization:

- direct costs

Notes

Country: Canada

Study period: 12 months

Nurse role: First contact and ongoing primary care

Nurse title: Nurse practitioners

Nurse educational background: EQF level unknown

Nurse years of experience: unknown

Nurse additional training: unknown

Venning 2000³³

Methods: RCT

Participants: 1316 patients (total group), all ages, 42% male. 20 nurses. Unknown number of doctors.

Interventions: patients allocated to nurse vs. patients allocated to doctor

Detailed description intervention: Compare care given by general practitioners and nurse practitioners for patients requesting a same day appointment.

Supervision, oversight: unknown

Outcomes

Patient outcomes:

- health status
- satisfaction
- compliance with follow-up attendance

- enablement

Process of care measures:

- examinations

Resource utilization:

- length of consultation
- return visits
- prescriptions
- investigations
- use of other services- hospital referral
- direct costs

Notes

Country: United Kingdom

Study period: 2 weeks

Nurse role: First contact care for patients with urgent problems

Nurse title: Nurse practitioners

Nurse educational background: EQF level 5, 6 and 7

Nurse years of experience: The median length of time the nurses had been qualified as nurse practitioners was 3 (range 15) years and the median time as registered nurses was 22 (935) years. Each nurse practitioner had been seeing patients as first point of contact for at least two years.

Nurse additional training: unknown

Voogdt-Pruis 2010³⁹ (including secondary studies^{56,57})

Methods: RCT

Participants: 1626 patients (1626 randomised, 701 trial population; 64% males). 6 practice nurses. 25 GPs

Interventions: patients with at cardiovascular risk allocated to practice nurses vs. patients at cardiovascular risk allocated to GPs.

Detailed description intervention: Comparing two groups following the Dutch guideline for cardiovascular risk management. Patients in the practice nurse group had a consultation with the practice nurse for assessment of other risk factors, and a 3-monthly monitoring schedule was set up for patients, but was adjusted individually according to the risk profile, (co)morbidity and patient preferences. Patients could be referred to other professionals, such as a dietician. Substitution of the following tasks:

- Risk assessment
- Interventions needed: advice on lifestyle, referral to dietist of other professional, adjustment of medical therapy

Supervision, oversight: unknown

Outcomes

Patient outcomes:

- blood pressure
- cholesterol
- BMI
- smoking
- satisfaction
- patients adherence to medical treatment after one year of follow-up
- patients' lifestyle after one year of follow-up

Process of care measures:

- Lifestyle and medical interventions
- Asking about the use of medication

Resource utilization:

- Referred to professionals
- Visited a cardiovascular specialist
- Admission into hospital because of CVD

Notes

Country: The Netherlands

Study period: not clear (1 measurement at 1 year with a not clear total period of the study)

Nurse role: Health education: secondary prevention consultation for patients with cardiovascular diseases

Nurse title: Practice nurse

Nurse educational background: EQF level 5

Nurse years of experience: unknown

Nurse additional training: All nurses received 1-day course on motivational interviewing and shared decision making.

Excluded studies

Almost all of the excluded full text articles were excluded because they investigated the role of nurses working as supplements to primary care doctors. We excluded one study where it was mixed primary care and hospital care.⁵⁸ Furthermore we excluded one study in this update that was included in the previous version of the review, but focused on mental health problems.⁵⁹ In addition, we excluded three controlled before-after studies from this update⁶⁰⁻⁶² and three non-randomised studies⁶³⁻⁶⁵ that were included in the previous version of the review.²¹ These studies are listed in the characteristics of excluded studies table (available online).

Risk of bias in included studies

An assessment of risk of bias was prepared for each trial. The final judgements for the ten criteria are illustrated in Figure 2 and Figure 3. All studies had some methodological shortcomings, in most instances relating to unclear risk of bias for different criteria. Only one study was judged to be at high risk of bias on more than one criteria (Mundinger 2000³²). The most commonly identified criteria assessed as unclear risk of bias were blinding of personnel, outcome assessment and selective reporting. The most commonly identified criterion assessed as high risk of bias was contamination (Lewis 1967³⁰; Mundinger 2000³²; Spitzer 1973²⁶; Voogdt-Pruis 2010³⁹).

Allocation (selection bias)

All studies stated patients to be randomly assigned, according to a computerized random scheme. Twelve of the included studies met the 'low risk of bias' criteria for random sequence generation. Most of these studies used a computer (Chan 2009³⁶; Hemani 1999³¹; Voogdt-Pruis 2010³⁹), or envelopes (Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Larsson 2014⁴¹; Shum 2000⁴³) for this purpose. For six studies, the risk of bias on random sequence generation was unclear due to poor reporting. In one

study (Campbell 2013²³), using a random component in the sequence process, 10 of the 15 practices withdrew after randomisation which made the risk of bias unclear.

Baseline values

Most studies had similar outcome measurements between the two study arms at baseline or corrected for differences in baseline values. In one study baseline characteristics were not assessed (Hemani 1999³¹) and in one study the study arms differed for one or two outcome measures (Larsson 2014⁴¹).

Blinding (performance bias and detection bias)

Risk of performance bias was low in two studies (Hemani 1999³¹; Voogdt-Pruis 2010³⁹). In one study personnel did not know which patients were included in the study (Hemani 1999³¹) or data was collected retrospective and patients were asked their consent after one year (Voogdt-Pruis 2010³⁹). For all other studies the risk of performance bias was judged to be unclear, since there was no information available. We expect that patients and personnel were not blinded in these studies because the care provider constitutes the intervention. Whether this lack of blinding influences the outcomes is unclear. Blinding of outcome assessors was satisfied in three studies (Chan 2009³⁶; Iglesias 2013³⁵; Ndosi 2013⁴⁰). Those studies provided independent researchers who were blind to group assignment when measuring the outcomes. Most studies did not provide sufficient information on the blinding of outcome assessment, and were therefore assessed as having unclear risk of detection bias.

Incomplete outcome data (attrition bias)

Three studies reported a follow-up less than 80% (Chambers 1978²⁴; Mundinger 2000³²; Venning 2000³³), and were therefore judged to have a high risk of bias for incomplete outcome data. In most studies, 80% or more of the initial participants completed the study. The risk of bias due to incomplete outcome data was unclear in Hemani 1999³¹ because of limited reporting about follow-up. Ndosi 2013⁴⁰ reported a follow-up less than 80%. However, both intention to treat and per protocol analyses were performed and reported the same results.

Selective reporting (reporting bias)

Two studies (Campbell 2013²³; Ndosi 2013⁴⁰) were judged to have a low risk for selective outcome reporting bias. A protocol was available for both studies and predefined outcome measures were reported in the paper. The absence of study protocols to confirm reporting of all intended outcomes led to the unclear judgement in all other studies.

Other potential sources of bias

Risk of bias due to contamination was high in four studies (Lewis 1967³⁰; Mundinger 2000³²; Spitzer 1973²⁶; Voogdt-Pruis 2010³⁹). These studies reported an increased likelihood of crossover of patients or personnel between groups. In six studies (Campbell 2013²³; Chan 2009³⁶; Dierick-van Daele 2009³⁷; Moher 2001²⁵; Ndosi 2013⁴⁰; Sanne 2010³⁴) contamination was not likely. Lack of information or insufficient details in the paper led to unclear judgement in the other studies.

Figure 2. Risk of bias graph (review authors' judgements about each risk of bias item presented as percentages across all included studies)

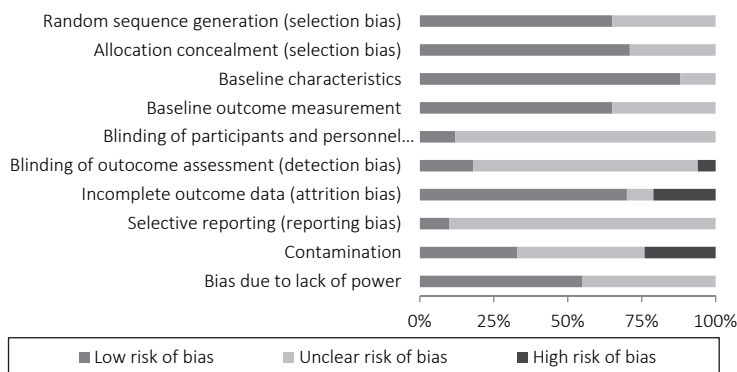


Figure 3. Risk of bias summary (review authors' judgements about each risk of bias item for each included study)

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Baseline characteristics	Baseline outcome measurement	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Contamination	Bias due to lack of power
Campbell 2013 ²³	?	+	+	+	?	?	+	+	+	+
Chambers 1978 ²⁴	?	?	+	+	?	?	-	?	?	?
Chan 2009 ³⁶	+	+	+	+	?	+	+	?	+	+
Dierick-van Daele 2009 ³⁷	+	+	+	?	?	?	+	?	+	?
Hemani 1999 ³¹	+	+	?	?	+	?	?	?	?	?
Houweling 2011 ³⁸	+	+	+	+	?	?	+	?	?	?
Iglesias 2013 ³⁵	+	+	+	?	?	+	+	?	?	+
Larsson 2014 ⁴¹	+	+	?	+	?	-	+	?	?	+
Lattimer 1998 ⁴²	+	+	+	?	?	?	+	?	?	+
Lewis 1967 ³⁰	?	?	+	+	?	?	+	?	-	?
Moher 2001 ²⁵	?	?	+	+	?	?	+	?	+	?
Mundinger 2000 ³²	?	?	+	+	?	?	-	?	-	+
Ndosi 2013 ⁴⁰	+	+	+	+	?	+	?	+	+	+
Sanne 2010 ³⁴	+	+	+	+	?	?	+	?	+	+
Shum 2000 ⁴³	+	+	+	?	?	?	+	?	?	+
Spitzer 1973 ²⁶	?	?	+	+	?	?	+	?	-	?
Venning 2000 ³³	+	+	+	?	?	?	-	?	?	?
Voogdt-Pruis 2010 ³⁹	+	+	+	+	+	?	+	?	-	+

Effects of interventions

Patient outcomes

Patient outcomes were investigated in 18 trials (Campbell 2013²³; Chambers 1978²⁴; Chan 2009³⁶; Dierick-van Daele 2009³⁷; Hemani 1999³¹; Houweling 2011³⁸; Iglesias 2013³⁵; Larsson 2014⁴¹; Lattimer 1998⁴²; Lewis 1967³⁰; Moher 2001²⁵; Mundingering 2000³²; Ndosi 2013⁴⁰; Sanne 2010³⁴; Shum 2000⁴³; Spitzer 1973²⁶; Venning 2000³³; Voogdt-Pruis 2010³⁹) (see Table 3). We have grouped outcomes into the following categories: mortality, health status outcomes, satisfaction, quality of life and others.

Mortality

Mortality was evaluated in eight trials (Campbell 2013²³; Hemani 1999³¹; Lattimer 1998⁴²; Ndosi 2013⁴⁰; Sanne 2010³⁴; Shum 2000⁴³; Spitzer 1973²⁶; Voogdt-Pruis 2010³⁹). Meta-analysis of data from these trials suggests that nurse-led primary care probably decreases mortality compared with doctor-led primary care (RR 0.77, CI 0.57 to 1.03, moderate certainty of the evidence). There was no evidence of heterogeneity ($I^2 = 0\%$ CI 0 to 68, $p = 0.48$) (Table 2 analysis 1.1). The evidence is of moderate certainty due to a wide CI that includes no effect (imprecision). Excluding a trial assessed as a cluster randomised trial from the meta-analysis (Lattimer 1998⁴²) confirmed that nurse-led primary care probably decreases mortality (RR 0.56, CI 0.33 to 0.95). Results did not change considerably in the other sensitivity analyses.

Health status

We have grouped health status outcomes into clinical outcomes (e.g. blood pressure, cholesterol, glycated haemoglobin (HbA1c)) and self-reported measurements of health status, including measures related to physical functioning (e.g. pain, Disease Activity Score (DAS)) and lifestyle factors (e.g. smoking, alcohol consumption, exercise).

Clinical outcomes

Clinical outcomes were evaluated in 3 trials (Houweling 2011³⁸; Mundingering 2000³²; Voogdt-Pruis 2010³⁹) focusing on patients with cardiovascular diseases or diabetes. Meta-analyses for blood pressure levels suggests that nurse-led primary care probably improves blood pressure outcomes compared to doctor-led care. Systolic blood pressure (MD -3.73 CI -6.02 to -1.44, *moderate certainty of the evidence*, Table 2 analysis 1.5) and diastolic blood pressure (MD -2.54 CI -4.57 to -0.52, *moderate certainty of the evidence*, Table 2 analysis 1.6). For both outcomes there was no

Table 2. Study results meta-analyses

<i>Outcome or Subgroup</i>	<i>Studies</i>	<i>Participants</i>	<i>Statistical Method</i>	<i>Effect Estimate</i>
1.1 Mortality	8	36529	Risk Ratio (IV, Random, 95% CI)	0.77 [0.57, 1.03]
1.2 Physical function (better vs not better)	3	3549	Risk Ratio (IV, Random, 95% CI)	1.03 [0.98, 1.09]
1.3 Pain	2		Mean Difference (IV, Random, 95% CI)	0.76 [-3.85, 5.38]
1.4 Quality of life	6	16002	Std. Mean Difference (IV, Random, 95% CI)	0.16 [0.00, 0.31]
1.5 Systolic blood pressure	3	1023	Mean Difference (IV, Random, 95% CI)	-3.73 [-6.02, -1.44]
1.6 Diastolic blood pressure	2	562	Mean Difference (IV, Random, 95% CI)	-2.54 [-4.57, -0.52]
1.7 Total cholesterol	2	702	Mean Difference (IV, Random, 95% CI)	-0.15 [-0.32, 0.02]
1.8 HbA1c	2	310	Mean Difference (IV, Random, 95% CI)	0.08 [-0.25, 0.41]
1.9 Disease Activity Score	2		Mean Difference (IV, Random, 95% CI)	0.04 [-0.17, 0.24]
1.10 Patient satisfaction	7	16993	Std. Mean Difference (IV, Random, 95% CI)	0.08 [0.01, 0.15]
1.11 Length of consultation	4	5848	Std. Mean Difference (IV, Random, 95% CI)	0.38 [0.22, 0.54]
1.12 Scheduled return visits	3	3934	Risk Ratio (IV, Random, 95% CI)	1.31 [0.89, 1.94]
1.13 Attended return visit	4	5064	Risk Ratio (IV, Random, 95% CI)	1.19 [1.07, 1.33]
1.14 Prescription ordered	4	5702	Risk Ratio (IV, Random, 95% CI)	0.99 [0.95, 1.03]
1.15 Investigations	4	3654	Risk Ratio (IV, Random, 95% CI)	0.95 [0.59, 1.51]
1.16 Hospital referral	4	17299	Risk Ratio (IV, Random, 95% CI)	0.90 [0.54, 1.49]
1.17 Attendance at Accident&Emergency	6	29905	Risk Ratio (IV, Random, 95% CI)	1.00 [0.91, 1.09]
1.18 Hospital admission	3	16466	Risk Ratio (IV, Random, 95% CI)	1.04 [0.78, 1.39]

evidence of heterogeneity (systolic blood pressure; $I^2 = 0\%$ CI 0 to 90 and diastolic blood pressure; $I^2 = 0\%$). The moderate certainty of the evidence is caused by a high risk of bias in one of the included studies (Mundinger 2000³²). Results did not change considerably under sensitivity analysis.

Meta-analyses for total cholesterol and HbA1c suggests that nurse-led primary care probably leads to similar outcomes, compared to doctor-led care for patients with health failure or diabetes (total cholesterol (MD -0.15 CI -0.32 to 0.02, high certainty of the evidence, Table 2 analysis 1.7), HbA1c levels (MD 0.08 CI -0.25 to 0.41, moderate certainty of the evidence, Table 2 analysis 1.8)). For both outcomes there was no evidence of heterogeneity (cholesterol; $I^2 = 0\%$ CI 0 to 90 and HbA1c; $I^2 = 0\%$). The moderate certainty of the evidence is caused by a high risk of bias in one of the included studies (Mundinger 2000³²). Results did not change considerably under sensitivity analyses.

Self-reported measurements of health status

Self-reported measurements of health status were undertaken in 12 trials (Chambers 1978²⁴; Chan 2009³⁶; Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Larsson 2014⁴¹; Lewis 1967³⁰; Moher 2001²⁵; Ndosi 2013⁴⁰; Sanne 2010³⁴; Spitzer 1973²⁶; Venning 2000³³; Voogdt-Pruis 2010³⁹). For the outcomes DAS and pain, we only found trials among patients with rheumatological diseases (Larsson 2014⁴¹; Ndosi 2013⁴⁰). Meta-analyses for DAS and pain suggested that nurse-led primary care probably leads to similar outcomes, compared to doctor-led care for patients with rheumatological diseases. (DAS: MD 0.04 CI -0.17 to 0.24, *high certainty of the evidence*, Table 2 analysis 1.9. Pain: MD 0.76 CI -3.85 to 5.38, *moderate certainty of the evidence*, Table 2 analysis 1.3). For both outcomes there was no evidence of heterogeneity (DAS; $I^2 = 1\%$ and Pain; $I^2 = 0\%$). The evidence for pain is of moderate certainty due to imprecision (wide CI that includes no effect). Results did not considerably change under sensitivity analysis.

Four studies assessing physical functioning were also included in a meta-analysis. Results suggested that nurse-led primary care may lead to similar outcomes, compared to doctor-led care (RR 1.03 CI 0.98 to 1.09, *low certainty of the evidence*, Table 2 analysis 1.2). The results were heterogeneous ($I^2 = 62\%$ CI 0 to 87, $p = 0.05$) which was probably caused by variation in the contexts of the trials. The evidence is of low certainty due to a imprecision and a high risk of bias. Although one trial in the analysis was assessed to have a high risk of bias (Chambers 1978²⁴), the results did not change considerably under sensitivity analysis.

In addition, a large number of other outcomes related to health status and lifestyle were measured. It was not possible to pool these because the nature of the outcomes was different, but the results suggest that care provided by nurses was at least as good as care provided by doctors. Details are summarised in Table 3.

Table 3. Patient outcome: health status

Study	Various health status outcomes
Chambers 1978 ²⁴	<i>Health status:</i> <ul style="list-style-type: none"> - Emotional function: no difference[#] - Social function: no difference[#]
Chan 2009 ³⁶	<i>Health status:</i> <ul style="list-style-type: none"> - Severity of symptoms: nurse group had greatest improvement. Difference adjusted for baseline 2.3 (CI 1.4–3.1), $p < 0.001$.
Dierick-van Daele 2009 ³⁷ (including secondary studies ⁴⁴)	<i>Health status:</i> <ul style="list-style-type: none"> - Burden of illness: nurse vs. doctor MD 0.27 $p = 0.16$ - Concerns about illness: nurse vs. doctor MD 0.11 $p = 0.20$ - Absence of work: both nurse and doctor 1.11 days (^#) - Ability to perform daily activities: nurse mean 2.53, doctor mean 2.69 (^#)
Houweling 2011 ³⁸	<i>Objective measures of patient health (MD [95% CI]):</i> <ul style="list-style-type: none"> - BMI (kg/m²): nurse -0.2 (-0.5; 0.1) doctor -0.3 (-0.6; -0.1) $p = 0.377$ - Cholesterol/HDL: nurse -0.03 (-0.1; 0.2) doctor -0.07 (-0.1; -0.2) $p = 0.321$ - Lipid profile: nurse $p = 0.008$ doctor $p = 0.002$ - <i>Health status:</i> <ul style="list-style-type: none"> - Diabetes symptom score: no difference^{#^} - Fatigue: no difference^{#^} - Cognitive distress: no difference^{#^}
Larsson 2014 ⁴¹ (including secondary studies ⁴⁵)	<i>Health status:</i> <ul style="list-style-type: none"> - DAS28-CRP: nurse vs doctor 0.05 (CI -0.28 to 0.19 $p = 0.70$) - ESR (mm/h): nurse vs doctor -1.05 (CI -3.97 to 1.86 $p = 0.47$) - CRP (mg/L): nurse vs doctor -1.07 (CI -2.02 to -0.12 $p = 0.03$) - Swollen joints (28): nurse vs doctor 0.13 (CI -2.18 to 0.61 $p = 0.60$) - Tender joints (28): nurse vs doctor 0.33 (CI -0.47 to 1.13 $p = 0.42$) - VAS Global health (mm): nurse vs doctor 4.29 (CI -2.58 to 11.16 $p = 0.22$)
Lewis 1967 ³⁰	<i>Health status:</i> <ul style="list-style-type: none"> - Resolution of symptoms in nurse group from 16.33 to 18.39 (possible range 6–24, higher scores means fewer reduction in complaints). Doctors no change. $p < 0.02$

Study	Various health status outcomes
Moher 2001 ²⁵	<i>Health status (lifestyle factor):</i> - Smoking: no difference (#) - Blood pressure (mm Hg) systolic: nurse 148 (142 - 153) GP 147 (135 - 153) p = 0.82 [#] - Blood pressure (mm Hg) diastolic: nurse 80 (74 - 87) GP 81 (75 - 83) p = 0.82 [#] - Cholesterol (mmol/l) total: nurse 5.4 (5.2 - 5.5) GP 5.5 (5.0 - 5.9) p = 0.61 [#] - Cholesterol (mmol/l) high density lipoprotein: nurse 1.2 (1.1 - 1.3) GP 1.2 (1.2 - 1.3) p = 0.83 [#]
Munding 2000 ³² (including secondary studies 49-51)	<i>Health status (10 dimensions):</i> no difference (\$) <i>Objective measures of patient health:</i> - Asthma - peak flow: NP 292.82 (94.2) GP 319.90 (136.56), p = 0.365
Ndosi 2013 ⁴⁰	<i>Health status:</i> - Fatigue ITT: nurse < doctor; mean (95% CI) 3.38 (-2.01, 8.76) p = 0.0171 - Stiffness ITT: nurse < doctor; mean (95% CI) 8.91 (-2.66, 20.5) p = 0.0113 - RAQoL ITT: nurse < doctor; mean (95% CI) -0.14 (-1.77, 1.49) p = 0.0001 - HAQ ITT: nurse > doctor; mean (95% CI) -0.07 (-0.21, 0.07) p < 0.0001 - HAD-Anxiety ITT: nurse < doctor; mean (95% CI) 0.54 (-0.36, 1.43) p = 0.0179 - HAD- Depression ITT: nurse < doctor; mean (95% CI) 0.12 (-0.65, 0.89) p = 0.0004 - ASES ITT: nurse > doctor; mean (95% CI) -0.92 (-4.96, 3.12) p = 0.0019
Sanne 2010 ³⁴	<i>Health status:</i> - Cumulative failure: nurse 48%, doctor 44% HR (95% CI) 1.09 (0.89, 1.33) - All virological failure: nurse 11% doctor 10% HR (95% CI) 1.15 (0.75-1.76) - Toxicity failure: nurse 17% doctor 16% HR (95% CI) 1.04 (0.74, 1.45) - Death: nurse 3% doctor 3% HR (95% CI) 0.92 (0.39, 2.17)
Spitzer 1973 ²⁶ (including secondary studies ^{52- 55})	<i>Health status:</i> - Physical function (3 indicators): nurses: 86%, physicians 88% [^] - Emotional function: nurses: 58%, doctors 58% [^] - Social function: nurses: 84%, doctors 83% [^]
Venning 2000 ³³	<i>Health status:</i> no difference [#]

Study	Various health status outcomes
Voogdt-Pruis 2010 ³⁹ (including secondary studies ^{56,57})	<p><i>Objective measures of patient health:</i></p> <ul style="list-style-type: none"> - LDL cholesterol: nurse: 2.9 doctors 3.0, p = 0.07 - BMI: nurse: 27.2 doctor 27.2, p = 0.87 <p><i>Health status (lifestyle factor):</i></p> <ul style="list-style-type: none"> - Smoking: 4% of smokers in the GP group (4/102) and 6% in the practice nurse group (4/67)[^] <p><i>Subgroup: at risk patients</i></p> <ul style="list-style-type: none"> - Systolic blood pressure: nurse: 144.0 doctor 147.6, p = 0.1 - Total cholesterol: nurse: 5.2 doctor 5.6, p = 0.006 - LDL cholesterol: nurse: 3.1 doctor 3.3, p = 0.16 - - BMI: nurse: 28.6 doctor 28.6, p = 0.78

([^]) authors only reported the direction of the outcome, its unknown if the difference is statistical significant.

([#]) authors reported no effect size or reported effect sizes in graphs (no exact effectsizes extracted)

([^]) no p value reported

MD = mean difference

Satisfaction and preference

Satisfaction with care was measured in 10 trials (Campbell 2013²³; Dierick-van Daele 2009³⁷; Iglesias 2013³⁵; Larsson 2014⁴¹; Lewis 1967³⁰; Mundinger 2000³²; Ndosì 2013⁴⁰; Shum 2000⁴³; Spitzer 1973²⁶; Venning 2000³³). This outcome was assessed in many different ways across the trials and therefore only seven trials could be included in a meta-analysis (Campbell 2013²³; Dierick-van Daele 2009³⁷; Iglesias 2013³⁵; Larsson 2014⁴¹; Mundinger 2000³²; Shum 2000⁴³; Venning 2000³³). This showed that patient satisfaction is probably slightly higher in nurse-led primary care, compared to doctor-led primary care (SMD 0.08, CI 0.01 to 0.15, *moderate certainty of the evidence*, Table 2 analysis 1.10). There was important heterogeneity in this result ($I^2 = 56\%$ CI 23 to 74), suggesting that the extent to which nurse-led care increased patient satisfaction varied considerably with the context of care. Results did not change considerably under sensitivity analysis. The findings of the trials not included in this meta-analysis also suggest that patients are probably at least as satisfied with nurse-led care as with doctor-led care. Table 4 summarises the data for all of the trials that assessed this outcome.

In addition, a large number of other outcomes related to satisfaction and preference were measured. It was not possible to pool these, but the results suggest that patients are at least as satisfied with nurses as with doctors. Details are summarised in Table 4.

Table 4. Patient outcome: satisfaction and preference

<i>Study</i>	<i>Satisfaction, preference</i>
Campbell 2013 ²³	<p><i>Overall satisfaction:</i> nurse triage vs GP triage MD: 2.60 (CI 0.58 to 4.63)[^]</p>
Dierick-van Daele 2009 ³⁷ (including secondary studies ⁴⁴)	<p><i>Overall satisfaction:</i> nurse vs. doctor (0-10) MD -0.015 p = 0.83</p> <p><i>Communication/attitude (1-6)</i></p> <ul style="list-style-type: none"> - Understanding: nurse vs. doctor MD -0.015 p = 0.41 - Telling the plan: nurse vs. doctor MD -0.02 p = 0.74 - Explanation goals and treatment: nurse vs. doctor MD -0.01 p = 0.76 - Importance advice: nurse vs. doctor MD -0.07 p = 0.17 - Appropriate attention: nurse vs. doctor MD 0.01 p = 0.78 <p><i>Provision of information (1-6)</i></p> <ul style="list-style-type: none"> - Causes problems: nurse vs. doctor MD -0.08 p = 0.21 - Relief symptoms: nurse vs. doctor MD -0.04 p = 0.47 - Duration illness: nurse vs. doctor MD -0.09 p = 0.25 - Change of recurrence: nurse vs. doctor MD -0.15 p = 0.08 - What to do: nurse vs. doctor MD -0.06 p = 0.45 <p><i>Subgroup at least 1 chronic conditions</i></p> <p><i>Satisfaction:</i> NP: 8.35 (1.07) vs. GP: 8.11 (1.32) p = 0.02</p> <p><i>Judgement seeing the right professional:</i> p = 0.35[#]</p> <p><i>Attending same provider in future:</i> p = 0.67</p> <p><i>Recommendation to others:</i> p = 0.41</p>
Iglesias 2013 ³⁵	<p><i>Satisfaction:</i></p> <ul style="list-style-type: none"> - Satisfaction with duration of the visit (0–10): doctor: 8.1 nurse: 8.4; MD (95% CI%) 0.256 (0.016-0.496)[^] - Satisfaction with personal attention (0–10): doctor: 8.1 nurse: 8.4 MD (95% CI%) 0.240 (0.003-0.476)[^] - Satisfaction with explanations and information received in the visit (0–10): doctor: 8.3 nurse: 8.5 MD (95% CI%) 0.240 (0.015-0.495)[^] <p><i>Provider preference:</i></p> <p>more than 40% of patients in each group expressed indifference. In the control group, 13.9% of patients would prefer to be seen by a nurse, as opposed to 20.9% in the intervention group[*]</p>
Larsson 2014 ⁴¹ (including secondary studies ⁴⁵)	<p><i>Confidence:</i></p> <ul style="list-style-type: none"> - NRS Confidence: nurse vs doctor 0.20 (CI -0.29 to 0.69) p = 0.42
Lewis 1967 ³⁰	<p><i>Provider preference:</i> doctor: 5.72 vs nurse 9.80, p <0.001. Possible range 0-20, higher scores indicate a more positive view of the provider.</p>

Study	Satisfaction, preference
Mundinger 2000 ³² (including secondary studies ⁴⁹⁻⁵¹)	<i>Satisfaction (9 items):</i> no difference in overall satisfaction, or on any of the 9 subscales (\$) <p><i>Would recommend provider to others:</i> no difference **</p>
Ndosi 2013 ⁴⁰	<i>Leeds Satisfaction Questionnaire - LSQ</i> <p>Week 26</p> <ul style="list-style-type: none"> - LSQ-General: nurse vs. doctor effect size: 0.17 p = 0.036 - LSQ-Information: nurse vs. doctor effect size: 0.08 p = 0.327 - LSQ-Empathy: nurse vs. doctor effect size: 0.05 p = 0.557 - LSQ-Technical: nurse vs. doctor effect size: 0.08 p = 0.293 - LSQ-Attitude: nurse vs. doctor effect size: 0.14 p = 0.082 - LSQ-Access: nurse vs. doctor effect size: 0.01 p = 0.936 <p>Week 52</p> <ul style="list-style-type: none"> - LSQ-General: nurse vs. doctor effect size: 0.12 p = 0.183 - LSQ-Information: nurse vs. doctor effect size: 0.09 p = 0.301 - LSQ-Empathy: nurse vs. doctor effect size: 0.05 p = 0.578 - LSQ-Technical: nurse vs. doctor effect size: 0.08 p = 0.369 - LSQ-Attitude: nurse vs. doctor effect size: 0.08 p = 0.375 - LSQ-Access: nurse vs. doctor effect size: 0.10 p = 0.248
Shum 2000 ⁴³	<i>Satisfaction:</i> <ul style="list-style-type: none"> - professional care: nurse: 79.2 (13.4) vs GP: 76.7 (15.1), possible range 0-100, p = 0.002 - relationship to provider: nurse: 64.3 (15.7) vs GP: 64.2 (16.9), possible range 0-100, p = 0.945 - adequacy of time: nurse: 73.3 (16.9) vs GP: 67.7 (19.3), possible range 0-100, p < 0.001 - explanation helpful: nurse: 88.8% vs GP: 87.3%, p = 0.359 - advice helpful: nurse: 86.9% vs GP: 83.9%, p = 0.060 <p><i>Provider preference:</i> GP group; 47.5% prefers GP, 2.0% nurse, 50.5% no preference. Nurse group; 31.5 prefers GP, 7.5% nurse, 61% no preference. p < 0.001</p>
Spitzer 1973 ²⁶ (including secondary studies ⁵²⁻⁵⁵)	<i>Satisfaction:</i> nurses: 96%, doctors 97% (^)

Study	Satisfaction, preference
Venning 2000 ³³	<p><i>Satisfaction:</i></p> <p>Adults</p> <ul style="list-style-type: none"> - Communication: NP: 4.35 (0.54) vs. GP 4.21 (0.60) $p = 0.001$ - Distress relief: NP: 4.43 (0.47) vs. GP 4.26 (0.57) $p = 0.001$ - Professional care: NP: 4.44 (0.49) vs. GP 4.22 (0.57) $p < 0.001$ <p>Children</p> <ul style="list-style-type: none"> - General: NP: 4.39 (0.46) vs. GP 4.17 (0.57) $p < 0.001$ - Communication with parent: no difference - Communication with child: NP: 4.16 (0.63) vs. GP 3.67 (0.77) $p < 0.001$ - Distress relief: NP: 4.41 (0.53) vs. GP 4.21 (0.64) $p = 0.002$ - Adherence intent: no difference

([†]) authors only reported the direction of the outcome, its unknown if the difference is statistical significant.

([‡]) authors reported no effect size or reported effect sizes in graphs (no exact effect sizes extracted)

([^]) no p value reported

MD = mean difference

Quality of life

Quality of life was evaluated in six trials (Campbell 2013²³; Chan 2009³⁶; Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Mundinger 2000³²; Ndosi 2013⁴⁰). Meta-analysis of data from these trials suggests that quality of life is probably slightly higher in nurse-led primary care compared to doctor-led primary care (SMD 0.16 CI 0.00 to 0.31, *moderate certainty of the evidence*, Table 2 analysis 1.4). The evidence is of moderate certainty due to inconsistency and heterogeneity ($I^2 = 85\%$ CI 69 to 93), caused by 1 trial (Chan 2009³⁶). This trial included a specific patient group i.e. people who had experienced dyspepsia after direct access gastroscopy. After excluding this trial, quality of life was still slightly higher in nurse-led primary care compared to doctor-led primary care and there was no evidence of heterogeneity. Furthermore, results did not change considerably under sensitivity analysis.

Other outcomes

A large number of other patient outcomes were measured, including patients' knowledge (understanding the health issue) and patient enablement (coping with his or her health issues). It was not possible to pool these, but the results suggest that care provided by nurses was probably at least as good as care provided by doctors. Details are summarised in Table 5.

Table 5. Patient outcome: compliance and other

Study	Compliance	Other
Mundinger 2000 ³² (including secondary studies ⁴⁹⁻⁵¹)		<i>Rating information (5 items): no difference[#]</i>
Venning 2000 ³³		<i>Enablement: nurse vs GP MD = 0.65 (CI-1.50 to 0.19), p = 0.13</i>
Voogdt-Pruis 2010 ³⁹ (including secondary studies ^{56,57})	<i>Patients adherence to medical treatment after one year of follow-up nurse vs doctor (95% CI)</i> <ul style="list-style-type: none"> - Medication blood pressure; 92.2 vs 84.9 (1.06 -3.73; p = 0.03) - Forgetting to take medication; group difference 1.32 (0.88 – 1.97; p = 0.18) - Never 52.6 vs 61.0 - Sometimes 46.8 vs 39.0 <i>Patients' lifestyle after one year of follow-up nurse vs doctor (95% CI)</i> <ul style="list-style-type: none"> - Exercise; 28.6 vs 27.3 (0.73 – 1.67; p = 0.79) - Alcohol 5 days per week at most ;78.6 vs 75.5 (0.79 – 2.01; p = 0.33) - Alcohol 2 for woman 3 for man at most; 79.1 vs 80.6 (0.53 – 1.56; p = 0.73) - Fat intake; 6.5 vs 7.2 (0.02 – 1.28; p = 0.04) 	

(^{*}) authors only reported the direction of the outcome, its unknown if the difference is statistical significant.

([#]) authors reported no effect size or reported effect sizes in graphs (no exact effectsizes extracted)

([^]) no p value reported

MD = mean difference

Processes of care outcomes

Process of care was investigated in 10 trials (Campbell 2013²³; Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Moher 2001²⁵; Mundinger 2000³²; Ndosi 2013⁴⁰; Shum 2000⁴³; Spitzer 1973²⁶; Venning 2000³³; Voogdt-Pruis 2010³⁹). Data are summarized in Table 6. Due to the large variety of approaches to measuring process of care, we did not judge it appropriate to pool trials in a meta-analysis. Overall, trials show some differences between nurses and primary care doctors in process of care measures. For example, nurses were reported to give more advice/information to patients and to

adhere to guidelines more frequently. The quality of patient examinations was probably little or not different between nurses and doctors. The certainty of evidence was moderate, due to the large variety of approaches to measure process of care.

Table 6. Process of care outcomes

Study	Provider Care
Campbell 2013 ²³	<p><i>Difficulty with</i> (nurse triage vs GP triage (MD [95% CI])):</p> <ul style="list-style-type: none"> - Phone access: 6.49 (-1.26 to 14.25)[^] - Receiving prompt care 6.63 (3.23 to 10.03)[^] - Seeing a doctor or nurse: 3.67 (-0.37 to 7.71)[^] - Getting medical help 5.09 (2.69 to 7.50)[^] - Convenience of care 3.68 (1.13 to 6.24)[^] <p><i>Problem resolution</i> (nurse triage vs GP triage: 0.41 (-1.86 to 2.67)[^]</p> <p><i>Proces indicators</i>:</p> <ul style="list-style-type: none"> - number of contacts per person: nurse vs GP triage (1.04, 1.01–1.08)[^] - 23% in the GP-triage group and 12% in the nurse-triage group had just one contact after their initial consultation request[*]
Dierick-van Daele 2009 ³⁷ (including secondary studies ⁴⁴)	<p><i>Adherence to guidelines</i>: nurse 79.8%, doctor 76.2%^{^#}</p>
Houweling 2011 ³⁸	<p><i>Proces indicators</i>:</p> <ul style="list-style-type: none"> - Patients with last retina control >24 months ago (n = 64) referred to an ophthalmologist: nurse 24/34 (70.6) vs GP 11/30 (36.7) p = 0.007 - Patients with feet at-risk (n = 109) in whom measures were taken: nurse 34/60 (56.7) vs GP 13/49 (26.5) p = 0.001 - Patients referred to an internist for starting insulin therapy: nurse 10/102 (9.8) vs GP 2/104 (1.9) p = 0.015 - Patients with a HbA1c ≥7 at baseline (n = 120), in whom glucose lowering therapy was intensified: nurse 53/64 (82.8) vs GP 28/56 (50.0) p = 0.001 - Patients with a BP >140/90 at baseline (n = 170) in whom blood pressure lowering therapy was intensified: nurse 42/85 (49.4) vs GP 24/85 (28.2) p = 0.005 - Patients not meeting the target values for lipid profile at baseline (n = 55), in whom lipid lowering therapy was intensified: nurse 13/29 (44.8) vs GP 13/26 (50.0) p = 0.147
Moher 2001 ²⁵	<p><i>Adequate assessment</i>:</p> <ul style="list-style-type: none"> - clinical assessment: nurse vs GP: 9% (95% CI -3 to 22), p = 0.13 - blood pressure: no difference[#] - cholesterol: no difference[#] - smoking status: no difference[#]

Study	Provider Care
Mundinger 2000 ³² (including secondary studies ⁴⁹⁻⁵¹)	<p><i>Documentation of provider behaviour diabetes care:</i></p> <ul style="list-style-type: none"> - Education (8 items): overall 'any education' nurse 84.9% versus doctor 42.4% ($p < 0.001$). With regard to specific items, nurse more education 4 out of 7 topics: nutrition, weight, exercise and medication ($p < 0.01$). - History taken (5 items): no difference. - Monitoring (9 items): nurse more laboratory test, urinalysis (nurse: 80.2%, doctor: 55.9%, $p < 0.01$), glycosylated haemoglobin (A1C value) (nurse: 81.4, doctor: 66.1, $p < 0.05$); nurse reported more frequently height of patients (nurse: 91.9% medical doctor 71.2% $p < 0.01$). Other 6 items no difference. - Referral (1 item): no differences.
Ndosi 2013 ⁴⁰	<p><i>Interventions:</i></p> <ul style="list-style-type: none"> - Patient education: nurse > doctor; RR (95% CI) 1.76 (1.15, 2.69) $p = 0.009$ - Psychosocial support: nurse > doctor; RR (95% CI) 3.29 (2.55, 4.24) $p < 0.0001$
Shum 2000 ⁴³	<p><i>Provision of information:</i></p> <ul style="list-style-type: none"> - Self-medication: nurse 22.2% vs. GP 13.7%, $p < 0.001$ - Self-management: nurse 81.7% vs. GP 57.6%, $p < 0.001$
Spitzer 1973 ²⁶ (including secondary studies ⁵²⁻⁵⁵)	<p><i>Adequate treatment:</i></p> <ul style="list-style-type: none"> - Drug treatment: nurses: 71%, doctors 75%[^] - Management of episodes: nurses: 69%, doctors 66%[^]
Venning 2000 ³³	<p><i>Examinations: nurse vs GP; MD 0.19 (CI -0.03 to 0.71), $p = 0.072$</i></p>
Voogdt-Pruis 2010 ³⁹ (including secondary studies ^{56,57})	<p><i>Lifestyle and medical intervention nurse vs doctor</i></p> <ul style="list-style-type: none"> - Smoking behaviour 8.2% vs. 3.2%[^] - Blood pressure 35.4% vs 26.6% (1.01 – 2.24; $p = 0.04$) - Lipids 47.1 vs 22.3 (1.98 – 4.43; $p < 0.01$) - Weight 36.9 vs 7.6 (4.26 – 12.52; $p < 0.01$) - Exercise 19.4 vs 3.2[^] - Food intake 14.6 vs 3.2[^] - Medication 22.3 vs 14.7 (0.99 – 2.59; $p = 0.05$) - None 22.8 vs 43.2 (1.69 – 3.86; $p < 0.01$) <p><i>Asked about the use of medication nurse vs doctor</i></p> <p>group difference 2.12 (1.38 – 3.26; $p < 0.01$)</p> <ul style="list-style-type: none"> - Never 57.4 vs 75.4 - Sometimes 20.0 vs 14.4 - Often 22.1 vs 9.7

([†]) authors only reported the direction of the outcome, its unknown if the difference is statistical significant.

([#]) authors reported no effect size or reported effect sizes in graphs (no exact effectsizes extracted)

([^]) no p value reported

([§]) too many numbers to report

Utilization outcomes

Utilization and costs were investigated in 16 trials (Campbell 2013²³; Chan 2009³⁶; Dierick-van Daele 2009³⁷; Hemani 1999³¹; Houweling 2011³⁸; Iglesias 2013³⁵; Larsson 2014⁴¹; Lattimer 1998⁴²; Lewis 1967³⁰; Moher 2001²⁵; Mundinger 2000³²; Ndosi 2013⁴⁰; Shum 2000⁴³; Spitzer 1973²⁶; Venning 2000³³; Voogdt-Pruis 2010³⁹). The range of outcomes varied across trials and were grouped into four categories: a) the length and frequency of consultations; b) the number of prescriptions, tests and investigations ordered; c) the use of other health care services, such as hospital admissions or referral to other professionals (see Table 7) and d) costs (see Table 8). The findings for each of the categories are below.

Consultations

Consultation length was investigated in seven trials Dierick-van Daele 2009³⁷; Houweling 2011³⁸; Iglesias 2013³⁵; Lewis 1967³⁰; Ndosi 2013⁴⁰; Shum 2000⁴³; Venning 2000³³. Four trials provided sufficient data for a meta-analysis on consultation length (Dierick-van Daele 2009³⁷; Iglesias 2013³⁵; Shum 2000⁴³; Venning 2000³³). This analysis suggests that nurses probably have longer consultations than doctors (SMD 0.38 CI 0.22 to 0.54, *moderate certainty of the evidence*, Table 2 analysis 1.11)). The results were heterogeneous ($I^2 = 90\%$ CI 80 to 95). The extent of heterogeneity suggest that differences in consultation length varied considerably with the context of care. On average, nurses' consultations were 39% [CI 30 to 52] longer than those with doctors. Results did not change considerably under sensitivity analysis. Results did not change.

Consultation rates in primary care (including overall consultation rates, return visits for whatever reason, and home visits) were investigated in 9 trials Dierick-van Daele 2009³⁷; Hemani 1999³¹; Houweling 2011³⁸; Iglesias 2013³⁵; Lewis 1967³⁰; Mundinger 2000³²; Ndosi 2013⁴⁰; Shum 2000⁴³; Venning 2000³³. Three trials provided sufficient data for a meta-analysis of return visits Dierick-van Daele 2009³⁷; Shum 2000⁴³; Venning 2000³³ and four trials on attended return visits (Dierick-van Daele 2009³⁷; Iglesias 2013³⁵; Shum 2000⁴³; Venning 2000³³). There is little or no difference in scheduled visits (RR 1.31; CI 0.89 to 1.94, *Moderate certainty of the evidence*, Table 2 analysis 1.12). Attended visits are probably higher in nurse-led primary care compared to doctor-led primary care (RR 1.19; CI 1.07 to 1.33: *high certainty of the evidence*, Table 2 analysis 1.13). For scheduled return visits, the evidence is of moderate certainty, due to high heterogeneity ($I^2 = 86\%$ CI 54 to 92). Results did not change considerably under sensitivity analysis.

The findings of the trials not included in the meta-analyses also suggest that consultations in nurse-led care were probably longer than in doctor-led care. Scheduled as well as attended return visits were also probably higher for nurse-led care. Furthermore, the workload of doctors was probably slightly lower in nurse-led care as well as the waiting time for patients in the waiting room. Table 7 summarises the data for all of the trials that assessed this outcome.

Numbers of prescriptions, tests and investigations

Rates of prescriptions, tests and investigations were evaluated in seven trials (Dierick-van Daele 2009³⁷; Hemani 1999³¹; Iglesias 2013³⁵; Moher 2001²⁵; Shum 2000⁴³; Venning 2000³³). Four trials provided sufficient data for a meta-analysis on number of prescriptions given (Dierick-van Daele 2009³⁷; Iglesias 2013³⁵; Shum 2000⁴³; Venning 2000³³) and four trials on frequency of tests and investigations (Dierick-van Daele 2009³⁷; Hemani 1999³¹; Venning 2000³³). Meta-analyses of data from these trials suggest that there is little or no difference between nurse-led care and doctor-led care in the likelihood of prescribing and ordering investigations (prescribing: RR 0.99, CI 0.95 to 1.03, *high certainty of the evidence*, Table 2 analysis 1.14 and frequency tests/investigation: RR 0.95, CI 0.59 to 1.51, *moderate certainty of the evidence*, Table 2 analysis 1.15)). For frequency of tests/investigations, the evidence is of moderate certainty, due to heterogeneity ($I^2 = 76\%$ CI 23 to 86) and a wide confidence interval, suggesting that the frequency of ordering tests/investigations between nurse-led care and doctor-led care varied with the context of care.

The findings of the trials not included in the meta-analyses also suggest no differences between nurse-led and doctor-led care on numbers of prescriptions and investigations/tests. Table 7 summarises the data for all of the trials that assessed this outcome.

Use of other services

Use of services, including referrals, specialty visits and hospital admissions was investigated in 14 trials Campbell 2013²³; Dierick-van Daele 2009³⁷; Hemani 1999³¹; Houweling 2011³⁸; Iglesias 2013³⁵; Larsson 2014⁴¹; Lattimer 1998⁴²; Mundinger 2000³²; Ndosi 2013⁴⁰; Shum 2000⁴³; Venning 2000³³; Voogdt-Pruis 2010³⁹. Of these 13 trials, five provided sufficient data for the meta-analysis on hospital referral (Houweling 2011³⁸; Lattimer 1998⁴²; Mundinger 2000³²; Venning 2000³³), five for the meta-analysis on attendance at accident & emergency unit (Campbell 2013²³; Iglesias 2013³⁵; Lattimer 1998⁴²; Mundinger 2000³²; Shum 2000⁴³) and three for the meta-

analysis on hospital admission (Lattimer 1998⁴²; Mundinger 2000³²). Meta-analyses of data from these trials suggest that there may be little or no difference between nurse-led care and doctor-led care in the likelihood of referrals (referrals: RR 0.90, CI 0.54 to 1.49, *low certainty of the evidence*, Table 2 analysis 1.16). There is little or no difference in attendance at accident & emergency (RR 1.00, CI 0.91 to 1.09, *high certainty of the evidence*, Table 2 analysis 1.17) and probably little or no difference in hospital admissions (RR 1.04, CI 0.78 to 1.39, *moderate certainty of the evidence*, Table 2 analysis 1.18). For referrals, the evidence is of low certainty due to heterogeneity ($I^2 = 50\%$ CI 0 to 86) and a wide confidence interval, suggesting that the extent to which the frequency of referrals differ between nurse-led care and doctor-led care varied with the context of care. For hospital admission, the evidence is of moderate certainty due to risk of bias in two of the included trials (Mundinger 2000³²). However, results did not change considerably in the sensitivity analysis.

The findings of the trials not included in the meta-analyses also suggest little or no differences between nurse-led and doctor-led care on other services. Table 7 summarises the data for all of the trials that assessed this outcome.

Table 7. Utilization outcomes

Study	Number, length, frequency of consultations	Numbers prescriptions, tests, investigations	Use of other services
Dierick-van Daele 2009 ³⁷ (including secondary studies ⁴⁴)			Referrals: nurse 12%, doctor 14.2% p = 0.24 [#]
Hemani 1999 ³¹	<p>Compared to qualified GPs</p> <p>Consultation rate:</p> <p>Nurse 3.52 vs qualified GPs 4.03 (p > 0.05)</p> <p>Compared to residents (trainee GPs)</p> <p>Consultation rate:</p> <p>Nurse 3.52 vs residents 2.95 (p < 0.05)</p>	<p>Mean utilization rate:</p> <p>Compared to qualified GPs</p> <p>Hospital admission: NP: 0.43 GP: 0.33, p > 0.05</p> <p>Emergency room visits: NP: 1.22 GP: 1.23, p > 0.05</p> <p>Specialty visits: NP: 5.35 GP: 4.26, p > 0.05</p> <p>Compared to residents (trainee GPs)</p> <p>Hospital admission: NP: 0.43 GP: 0.31, p > 0.05</p> <p>Emergency room visits: NP: 1.22 GP: 1.05, p > 0.05</p> <p>Specialty visits: NP: 5.35 GP: 4.21, p > 0.05</p>	

Houweling 2011³⁸

Mean number of visits: nurse: 6.1, GP 2.8 (p < 0.0001)

Total duration of visits: significant higher in nurse group[#]

Consultation of nurses' patients with a GP:

The median number of these consultations per patient was 1.4 (25–75 quartiles: 0.0–2.0) with a median time of 1.0 (25–75 quartiles: 0.0–3.3) minute.

Study	Number, length, frequency of consultations	Numbers prescriptions, tests, investigations	Use of other services
Iglesias 2013 ³⁵	Level of resolution by nurses: Nurses soled 86.3% (95% CI: 83.6-88.7) of the consultations without referral to the GP (referrals according to protocol indication not included)		
Larsson 2014 ⁴¹ (including secondary studies ⁴⁵)		<p><i>Proportion nurse-led vs doctor-led</i></p> <ul style="list-style-type: none"> - cortisone injections in addition to regular rheumatologist monitoring visits (1:0.7; p = 0.463). - blood tests (1:3.9; p = 0.014) - radiography (1:1.6; p = 0.162) - pharmacological therapy (1:1.1; p = 0.029) 	<p><i>Proportion nurse-led vs doctor-led</i></p> <ul style="list-style-type: none"> - additional telephone calls to a rheumatology nurse (1:1.8; p = 0.060) - additional telephone calls to a rheumatologist (1:1.9; p = 0.287) - additional rheumatologist visits (1:2.4; p = 0.077) - team rehabilitation in inpatients settings (0:7.9; p = 0.086), - team rehabilitation in outpatient settings (15:0; p = 0.135) - occupational therapist (0:3.0; p = 0.162) - psychosocial treatments (0:1.0; p = 0.152) - specialist consultations (1:1.0; p = 0.949) <p><i>Hospital admission within 24 hours:</i> nurse: 2%, GP 6.5% RR = 0.31 (CI 0.07 to 1.42) <i>Hospital admission within 3 days:</i> nurse: 5%, GP 6.5% RR = 0.77 (CI 0.26 to 2.28) <i>Emergency room visit:</i> nurse: 3%, GP 2% RR = 1.84 (CI 0.31 to 10.82)</p>
Lattimer 1998 ⁴² (including secondary studies ⁴⁶⁻⁴⁸)	<p><i>Impact on GPs' workload:</i></p> <ul style="list-style-type: none"> - Telephone advice from GP: fewer with nurse-led care, 35% reduction[*] - Surgery visits: 10% fewer with nurse-led care[*] - - Home visits: 6% fewer home visits during intervention period[*] 		

Study	Number, length, frequency of consultations	Numbers prescriptions, tests, investigations	Use of other services
Lewis 1967 ³⁰	Consultation length: doctor 15 minutes, nurse 30 minutes* Consultation rate: doctor 150 visits, nurse 345 visits*		Days in hospital: doctor 68 days, nurse 45 days*
Moher 2001 ²⁵		<p><i>Prescriptions:</i></p> <ul style="list-style-type: none"> - Anti-hypertensives: no difference, $p = 0.35$ # - Lipid lowering: no difference, $p = 0.63$ # - Antiplatelet: nurse 8% (95% CI 1-9%) more than GP ($p = 0.031$) 	
Mundinger 2000 ³² (including secondary studies ⁴⁹⁻⁵¹)	Consultation rate: doctor patients had higher primary care utilization than nurse practitioner patients (2.50 versus 1.76 visits, $p = 0.05$)		Speciality visits: no difference (\$), $p = 0.61$
Ndosi 2013 ⁴⁰	<p><i>Consultation length:</i></p> <p>Mean total consultation time nurse 111 min, doctor 71 min^{^#}</p> <p><i>Consultation rate:</i></p> <p>Patients attending all five sessions: nurse 92%; doctor 85%^{^#}</p>	<p><i>Prescriptions:</i></p> <ul style="list-style-type: none"> - Change of medicines: nurse < doctor; RR (95% CI) 0.58 (0.43, 0.79) $p = 0.0006$ - Dosage changes: nurse < doctor; RR (95% CI) 0.52 (0.34, 0.79) $p = 0.0020$ - Intra-articular injections: nurse < doctor; RR (95% CI) 0.82 (0.50, 1.35) $p = 0.4400$ - Intra-muscular injections: nurse < doctor; RR (95% CI) 0.73 (0.45, 1.19) $p = 0.2100$ - Non-protocol bloods: nurse < doctor; RR (95% CI) 1.02 (0.74, 1.40) $p = 0.91$ 	<ul style="list-style-type: none"> - Referral to physiotherapy: nurse < doctor; RR (95% CI) 1.21 (0.62, 2.39) $p = 0.5800$ - Referral to occupational therapy: nurse < doctor; RR (95% CI) 1.74 (0.76, 3.96) $p = 0.1900$ - Referral to podiatry: nurse < doctor; RR (95% CI) 0.89 (0.37, 2.14) $p = 0.8000$ - Confrerrals: nurse < doctor; RR (95% CI) 2.92 (1.77, 4.83) $p < 0.0001$ - Referral to other consultants: nurse < doctor; RR (95% CI) 0.58 (0.11, 3.11), $p = 0.5200$

Study	Number, length, frequency of consultations	Numbers prescriptions, tests, investigations	Use of other services
Shum 2000 ⁴³			Out-of-hours-calls: nurse 0.9% vs GP 1.8%, p = 0.218
Venning 2000 ³³		Physical examinations: nurse vs GP; MD 0.19 (95% CI -0.03 to 0.71), p = 0.072	
Voogdt-Pruis 2010 ³⁹ (including secondary studies ^{56,57})			<i>Referred to professionals nurse vs doctor</i> - Dietician 17.0 vs 8.9 [^] - Physiotherapist 3.1 vs 1.9 [^] - Cardiovascular specialist 1.9 vs 6.3 [^] - Visited a cardiovascular specialist 46.3 vs 45.3 (0.84 – 1.79; p = 0.30) - Admission into hospital because of CVD 10.4 vs 13.4 (0.43 – 1.38; p = 0.38)

^(*) authors only reported the direction of the outcome, its unknown if the difference is statistical significant.

^(#) authors reported no effect size or reported effect sizes in graphs (no exact effectsizes extracted)

^(^) no p value reported

Costs

The cost of care was investigated in nine trials (Campbell 2013²³; Chambers 1978²⁴; Chan 2009³⁶; Dierick-van Daele 2009³⁷; Lattimer 1998⁴²; Lewis 1967³⁰; Ndosi 2013⁴⁰; Spitzer 1973²⁶; Venning 2000³³) (Table 8). Due to the large variety of approaches used to value the resources and calculate cost, we did not pool trials in a meta-analysis. Cost of care was estimated in three trials (Dierick-van Daele 2009³⁷; Lattimer 1998⁴²; Venning 2000³³) for nurses providing first contact care; in two trials (Chambers 1978²⁴; Spitzer 1973²⁶) for nurses providing first contact and ongoing care; and in three trials (Chan 2009³⁶; Lewis 1967³⁰; Ndosi 2013⁴⁰) for nurses providing ongoing care for patients with chronic diseases. Data from the trials may suggest little or no difference in cost of care between nurse-led care and doctor-led care. The certainty of this evidence was low, due to inconsistency in effect and indirectness, i.e. the large variety of approaches used to value the resources and calculate cost.²⁹ For instance, one trial based their calculation of costs only on medications that were prescribed (Chan 2009³⁶) while another trial (Campbell 2013²³) calculated costs based on staff training, set up of the intervention, costs of computer decision support software, clinician triage time and levels of resource use on other primary care contacts by patients (Table 8).

Table 8. Cost outcomes

<i>Study</i>	<i>Costs based on</i>	<i>Cost outcomes</i>
Campbell 2013 ²³	<ul style="list-style-type: none"> - staff training - set-up of the interventions - cost of computer decision support software in nurse triage - clinician triage time - patient-level quantities of resource use on other primary care contacts 	<p><i>Total costs:</i></p> <p>Mean 28-day cost estimates for primary outcome contacts</p> <p>nurses - £75.68 (63.09)</p> <p>GP - £75.21 (65.45)</p>
Chan 2009 ³⁶	<ul style="list-style-type: none"> - medication use 	<p><i>Costs medication use:</i></p> <p>Nurses – mean £35.5 (SD £48.8)</p> <p>Doctors – mean £71.7 (SD £ 63.1)</p> <p>Mean difference (adjusted baseline level): £39.6 (95%CI: 24.2; 55.1); p < 0.001</p>

Study	Costs based on	Cost outcomes
Dierick-van Daele 2009 ³⁷ (including secondary studies ⁴⁴)	<ul style="list-style-type: none"> - Direct health care costs - Prescriptions - Diagnostic procedures - Referrals (in the 2 weeks after consultation) - Follow-up consultation - Length of consultations - Salary costs - Costs outside the health care sector - Sick leave days 	<p><i>Total direct health care costs:</i></p> <p>Nurse: €31.94</p> <p>Doctors: €40.15</p> <p>Mean difference (95% CI): €8.21 (3.56; 12.85); p = 0.001</p> <p><i>Total direct health care costs and productivity:</i></p> <p>Nurse: €140.40</p> <p>Doctors: €145.87</p> <p>Mean difference (95% CI): €1.48 (-4.94; 7.90); p = 0.65</p> <p>Subgroup younger 65 year:</p> <p><i>Total direct health care costs and productivity:</i></p> <p>Nurse: €161.57</p> <p>Doctors: €170.75</p> <p>Mean difference (95% CI): €9.18 (4.84; 13.88); p < 0.001</p>
Larsson 2014 ⁴¹ (including secondary studies ⁴⁵)	<ul style="list-style-type: none"> - fixed monitoring (monitoring visit at 6 months to a rheumatology nurse a rheumatologist; for both groups a monitoring visit at 12 months to a rheumatologist and monitoring blood tests) - variable monitoring (additional telephone calls to a rheumatology nurse, additional telephone calls - to a rheumatologist (additional rheumatologist visits, cortisone injections in addition to regular rheumatologist monitoring visits, and additional blood tests) - rehabilitation (team rehabilitation days of care in inpatient and outpatient settings, individual physiotherapy treatments, occupational therapist treatments, and psychosocial treatments) - specialist consultations (orthopaedic surgeon, hand surgeon, dermatologist, and orthotist) - radiography (standard X-ray and Dual energy X-ray absorptiometry (DEXA) scanning) - pharmacological therapy 	<p><i>Total annual rheumatology care per patient</i></p> <p>Nurse-led: €14107,70</p> <p>Doctor-led: €16274,90</p> <p>Mean difference (95% CI): -2167.2 (-3757.3 to -641.7)</p> <p>p = 0.004</p>

Study	Costs based on	Cost outcomes
Lattimer 1998 ⁴² (including secondary studies ⁴⁶⁻⁴⁸)	<ul style="list-style-type: none"> - costs for nurse telephone consultation - recruitment - nurse salaries - indemnity insurance - cooperative management - education programme - 1 H grade – 0.25 whole time equivalent - 10 days lecturer B - Technical support - Computers - Decision support software - Furniture - Telephones - Digital tape recorder - Savings - emergency hospital admission - home visits by general practitioner - surgery attendances within three days 	<p><i>Annual direct cost</i> nurse-led service £81,237 more than doctor-led service</p> <p><i>Savings:</i> generated in reduced hospital and primary care utilization £94,422</p> <p><i>Net reduction in costs with nurse-led service</i> £3,728 - £123,824 (determined by sensitivity analysis)</p>
Lewis 1967 ³⁰	<ul style="list-style-type: none"> - cost per hour of the time of physicians and nurses - length of visits - total number of visits - total days of inpatient care - Unknown other costs 	<p><i>Total direct cost per year:</i> nurses - \$3,251 doctors - \$4,199</p> <p><i>Average cost per patient per year:</i> nurses - \$98.51 doctors - \$127.24</p>
Ndosi 2013 ⁴⁰	<ul style="list-style-type: none"> - resource use - health professional consultations (primary and secondary care) - hospital admissions (day care, inpatient stays, A&E visits) - investigations, and treatments including over-the-counter medications - private out-of-pocket expenditure - health care service use - travel - medication - aids - special dietary requirements - productivity losses 	<p><i>NHS resources plus out-of-pocket expenditure</i> nurses mean - £1276 doctors mean - £2286 (95% CI -352 to 1773) p = 0.1872</p>

Study	Costs based on	Cost outcomes
Spitzer 1973 ²⁶ (including secondary studies ⁵²⁻⁵⁵)	<ul style="list-style-type: none"> - physician - nurse (including nurse practitioner) - hospital and extended care - dentist - optometrist/ optician - chiropractor - podiatrist - laboratory - diagnostic radiography - direct cash expenditures 	<i>Average cost per patient per year^a</i> nurses - \$297.01 doctors – \$285.67
Venning 2000 ³³	<ul style="list-style-type: none"> - basic salary costs of each health professional - prescriptions - tests - referrals - return consultations in the following two weeks 	<i>Total direct cost per consultation:</i> Nurses – mean £18.11 (sd £33.43; range £0.66 - £297.1) Doctors – mean £20.70 (sd £33.43; range £0.78 - £300.6) Mean difference (adjusted age, sex): £2.33 (95%CI: - 1.62; 6.28); p = 0.247

^a Spitzer 1973²⁶ reported an overall reduction in practice costs following the introduction of nurse practitioners but this finding was based on observational before-and-after data. Data obtained from the related randomised controlled trial (reported above) did not support this finding.

DISCUSSION

Summary of main results

This review identified 18 randomised trials evaluating the impact of nurses working as doctors' substitutes. One study was from a low-income country, and all the other studies were from high-income countries. The nursing level was often unclear or varied between and even within studies.

The findings suggest that care delivered by nurses, compared to care delivered by doctors probably generates similar or better health outcomes for a broad range of patient conditions (moderate certainty evidence):

- Mortality is probably decreased in nurse-led primary care.
- Blood pressure outcomes are probably improved in nurse-led primary care. Other clinical or health status outcomes are probably similar.
- Patient satisfaction and quality of life are probably slightly higher in nurse-led primary care.

Results suggest an improvement in processes of care associated with nurse-led care such as patient education and adherence to guidelines (moderate certainty evidence). However, an overall effect size could not be measured.

The effect of nurse-led care on utilization is mixed and depends on the type of outcome. Consultation length is probably longer in nurse-led primary care and scheduled and attended return visits are probably slightly higher for nurses, compared to doctors (moderate certainty evidence). There is little or no difference between nurses and doctors in frequency of prescriptions, tests and investigations and in patients' use of other services as home visits (moderate certainty evidence). Nurse-led care may make little or no difference to cost of care compared to doctor-led primary care (low certainty evidence). An overview can be found in Table 9.

Overall completeness and applicability of evidence

The results of this review provide guidance to health policy makers in primary care. There are some issues that need to be considered when making judgements about the applicability of these findings for the implementation of nurses in primary care systems. First, we were able to identify a high number of studies published till January 2015, which were sufficient to address all of the objectives of the review. We included a high variation in nurses (both with regard to educational level and nurses' roles), health-care systems, and care provided to general patient populations as well as target groups of patients. However, there were few studies in each comparison and often details (such as nursing education level) were missing. Therefore, we were not able to conduct subgroup analyses. As a result, it was not possible to draw conclusions on the influence of type of nurse on the outcomes. Second, in some studies the intervention in the nurse-led group and the doctor-led group were somewhat different. For example, nurses had protocols or were offered a computerized decision tool and doctors were not (Campbell 2013²³; Houweling 2011³⁸; Iglesias 2013³⁵; Lattimer 1998⁴²). In other studies, nurses' patients were given an appointment where doctors' patients were only advised to see their doctor (Chan 2009³⁶) or nurse-led care included a longer time slot (Ndosi 2013⁴⁰). Differences in the interventions might have influenced the study outcomes. Lastly, in the last 10 years since our previous review was published, primary care services have changed. However, there does not seem to be a trend in type of substitution from doctors to nurses, or a trend in the outcomes, reflecting these changes in primary care services. The results of this update of the review are consistent with our previous review and other published reviews.^{10,14-17,66,67}

Quality of the evidence

The review included studies from a wide range of nursing levels, patient groups and countries. We were able to review many different outcomes, but with various quality of evidence. For studies included in meta-analyses, the evidence for most outcomes was of moderate quality. Most meta-analyses were small, resulting in poor heterogeneity estimates. However, even if heterogeneity is not detected it is very likely that it is present.²⁸

For some studies we were not able to conduct meta-analyses and could only describe results narrative. The diversity in outcomes made drawing overall conclusions difficult.

All studies have some methodological shortcomings, which lead to downgrading of the evidence. For example assessing large numbers of outcomes increases the probability of finding statistically significant differences by chance. Another shortcoming includes the fact that for the type of intervention evaluated it is almost impossible to blind patients and personnel. Although this lack of blinding influences the outcomes is unclear, we believe this influence will be limited. It is possible that methodological shortcomings/biases lead to an overestimation or underestimation of the effects. These qualifications should be taken into account when drawing the conclusions and for policy makers these consideration should be taken into account in drawing health policy plans.

The risk of bias was often unclear. Serious concerns relate to the lack of power calculations, small number of participating nurses and heterogeneous trials. Due to the methodological limitations of the included studies there is a danger of type I and type II errors.

Potential biases in the review process

Our search strategy was designed to maximise sensitivity (detection of relevant research) at the expense of specificity (excluding irrelevant research). Even so, relevant research proved difficult to identify and some papers may have been missed.

The review process itself was carried out according to guidelines for conducting a systematic review. Therefore, we are confident in the quality of the review itself, although publication bias cannot be ruled out. Publication bias seems unlikely as the clinical and research communities are interested equally in whether nurses perform equal or better to doctors or the reverse.

Table 9. Summary of findings

Outcomes	Impact			Number of participants (studies)	Certainty of the evidence (GRADE)	
	Illustrative comparative risks* (95% CI)		Results in words			
	Assumed risk	Corresponding risk				
	Doctor-led care	Nurse-led care				
Mortality follow-up: 2 to 48 months. Mean = 14 (sd 12) months	6.29 per 1000	4.84 per 1000	RR 0.77 (0.57 to 1.03)	36528 (8) ¹	⊕⊕⊕⊕ ^a moderate	
Patient health status follow-up: 2 to 48 months. Mean = 14 (sd 12) months	Nurse-led primary care probably improves blood pressure outcomes, compared to doctor-led care, and probably leads to similar outcomes to doctor-led care for heart disease indicators, diabetes indicators and rheuma indicators.			Clinical outcomes (3) Self-reported measurements (13) ²	⊕⊕⊕⊕ ^b moderate	
Satisfaction and preference follow-up: 2 to 48 months. Mean = 14 (sd 12) months	The mean satisfaction with nurse-led care was 0.08 standard deviations higher (0.01 to 0.15 higher)			Patient satisfaction is probably slightly higher in nurse-led care compared to doctor-led care.	16993 (7) ³	⊕⊕⊕⊕ ^c moderate
Quality of life follow-up: 2 - 48 months. Mean = 14 (sd 12) months	The mean quality of life of nurse-led care was 0.16 standard deviations higher (0.00 to 0.31 higher)			Quality of life is probably slightly higher in nurse-led care compared to doctor-led care (SMD 0.16, CI 0.00-0.31).	16002 (6) ⁴	⊕⊕⊕⊕ ^d moderate
Process of care	Nurses probably give more advice to patients and may adhere to guidelines more frequently, compared to doctors. There may be little or no difference between nurses and doctors in the quality of examinations.			(10) ⁵	⊕⊕⊕⊕ ^e moderate	
Utilization (consultations, prescriptions, tests, investigations and services) follow-up: 2 - 48 months. Mean = 14 (sd 12) months	Consultation length is probably longer (SMD 0.38 [CI 0.22-0.54]). Attended return visits probably higher for nurses, compared to doctors (RR 1.19 [CI 1.07, 1.33]). There is little or no difference between nurses and doctors in frequency of prescriptions, tests and investigations and in patients' use of other services.			(16) ⁶	⊕⊕⊕⊕ ^f moderate	
Costs	Nurse-led care may make little or no difference to cost of care compared to doctor-led care.			(9) ⁷	⊕⊕⊕⊕ ^g low	

<p>*The basis for the assumed risk is the mean control group risk across studies for pooled results. The <i>corresponding risk</i> is based on the assumed risk in the comparison group and the <i>relative effect</i> of the intervention (and its 95% CI).</p> <p>CI: confidence interval; RCT: randomised controlled trial; RR: risk ratio; SMD: standardized mean difference.</p> <p>a. Downgraded by 1 for imprecision, due to a wide CI that includes no effect.</p> <p>b. Downgraded by 1. Some outcomes were downgraded by 1 for inconsistency (physical functioning and DAS), effect varies between trials. Other outcomes (Tot. cholesterol, HbA1C) were downgraded by 1 for imprecision, due to a wide CI.</p> <p>c. Downgraded by 1 for heterogeneity. There was important heterogeneity in this result ($I^2 = 65\%$ CI 25-84), suggesting that the extent to which nurse-led care increased patient satisfaction varied considerably with the context of care.</p> <p>d. Downgraded by 1 for imprecision, due to a wide CI that includes no effect.</p> <p>e. Downgraded by 1, due to no overall effect size</p> <p>f. Downgraded by 1. Some outcomes were downgraded by 1 for important heterogeneity (length of consultations and scheduled return visits). There was important heterogeneity in length of consultations and scheduled return visits, suggesting that the extent to which nurse-led care increased length of consultation and scheduled return visits varied considerably with the context of care. Some outcomes were downgraded by 1 for inconsistency (investigations and hospital referral), effect varies between trials. Hospital admission was downgraded by 1 for limitations in the design of the trials. Mundiger has a higher risk of bias.</p> <p>g. Downgraded by 2, due to inconsistency (effect varies between trials) and no overall effect size.</p>	
1.	Campbell 2013 ²³ , Hemani 1999 ³¹ , Lattimer 1998 ⁴² , Ndosì 2013 ⁴⁰ , Sanne, 2010 ³⁴ , Shum 2000 ⁴³ , Spitzer 1973 ²⁶ , Voogdt-Pruis 2010 ³⁹
2.	Campbell 2013 ²³ , Chambers 1978 ⁴⁴ , Chan 2009 ³⁶ , Dierick-van Daele 2009 ³⁷ , Houweling 2011 ³⁵ , Iglesias 2013 ³⁵ , Larsson 2014 ⁴¹ , Lattimer 1998 ⁴² , Lewis 1967 ³⁰ , Moher 2001 ²⁵ , Mundinger 2000 ³² , Sanne, 2010 ³⁴ , Shum 2000 ⁴³ , Spitzer 1973 ²⁶ , Venning 2000 ³³ , Voogdt-Pruis 2010 ³⁹
3.	Campbell 2013 ²³ , Dierick-van Daele 2009 ³⁷ , Iglesias 2013 ³⁵ , Larsson 2014 ⁴¹ , Mundinger 2000 ³² , Shum 2000 ⁴³ , Venning 2000 ³³
4.	Campbell 2013 ²³ , Chan 2009 ³⁶ , Dierick-van Daele 2009 ³⁷ , Houweling 2011 ³⁵ , Mundinger 2000 ³² , Ndosì 2013 ⁴⁰
5.	Campbell 2013 ²³ , Dierick-van Daele 2009 ³⁷ , Houweling 2011 ³⁵ , Moher 2001 ²⁵ , Mundinger 2000 ³² , Ndosì 2013 ⁴⁰ , Shum 2000 ⁴³ , Spitzer 1973 ²⁶ , Venning 2000 ³³ , Voogdt-Pruis 2010 ³⁹
6.	Campbell 2013 ²³ , Chan 2009 ³⁶ , Dierick-van Daele 2009 ³⁷ , Hemani 1999 ³¹ , Houweling 2011 ³⁵ , Iglesias 2013 ³⁵ , Larsson 2014 ⁴¹ , Lattimer 1998 ⁴² , Lewis 1967 ³⁰ , Moher 2001 ²⁵ , Mundinger 2000 ³² , Ndosì 2013 ⁴⁰ , Shum 2000 ⁴³ , Spitzer 1973 ²⁶ , Venning 2000 ³³ , Voogdt-Pruis 2010 ³⁹
7.	Campbell 2013 ²³ , Chambers 1978 ⁴⁴ , Chan 2009 ³⁶ , Dierick-van Daele 2009 ³⁷ , Lattimer 1998 ⁴² , Lewis 1967 ³⁰ , Ndosì 2013 ⁴⁰ , Spitzer 1973 ²⁶ , Venning 2000 ³³
8.	Note that a small clinically appreciable benefit was set at SMD < 0.2, and a moderate benefit at SMD of 0.5 to 0.8
GRADE Working Group grades of evidence	
<i>High certainty:</i> This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different [†] is low	
<i>Moderate certainty:</i> This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different [†] is moderate	
<i>Low certainty:</i> This research provides some indication of the likely effect. However, the likelihood that it will be substantially different [†] is high	
<i>Very low certainty:</i> This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different [†] is very high	
[†] This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'	
[†] Substantially different = a large enough difference that it might affect a decision	

Agreements and disagreements with other studies or reviews

Current update of the original published review in 2005 (Laurant 2005) shows similar results of the original review in terms of health outcomes for patients, process of care and resource utilization.

In the recent years, several other authors also published reviews have been published on nurses in primary care.^{10,14-17,67-72} Although the outcomes of our current review are in line with those of other reviews, there are also differences that might be explained by differences in methods between the reviews. Our review is most closely related to the reviews of Martínez-González et al.^{10,14-17} Although they used inclusion criteria similar to ours, there were differences in the included studies. They included some studies in which we thought the nurses rather supplemented the care provided by doctors than taking over tasks from the doctors.^{58,73-82} On the other hand, we included Chambers 1978²⁴; Lattimer 1998⁴²; Moher 2001²⁵; Sanne 2010³⁴ and Spitzer 1973²⁶, that we not included in the reviews from Martinez-Gonzalez. Although some studies were not presented by the authors themselves as a nurse-doctor substitution study because they evaluated the effectiveness of one treatment instead of general primary care (for example Moher 2001²⁵; Sanne 2010³⁴), they did comply to our inclusion criteria as the same type of treatment was carried out by a nurse in the one group and a doctor in the other group. Our review also has overlap and differences with the other reviews. A major difference with all reviews include its rigorous methodology according to Cochrane Handbook. Other methodological differences are presented in Table 10.

Several reviews found similar results to ours in terms of reductions in mortality in nurse-led primary care, compared to doctor-led primary care.^{14,72} However, one review showed that mortality rates were similar across these cadres, possibly due to differences in inclusion criteria of studies.⁷¹ All other reviews found similar results to ours in terms of an equal or higher health status for patients who received care from nurses compared to doctors.^{17,71,72}

Other reviews found similar to us that nurse-led care probably leads to higher patients satisfaction;^{14,66,67,72} a slightly higher quality of life;¹⁴ longer consultation length and higher rate of return visits compared to doctor-led care.^{10,66,67,69} Just like Martínez-González¹⁰ current review shows that there is little or no difference between nurses and doctors in frequency of prescriptions, tests, investigations and in patients' use of other services. However, Horrocks⁶⁶ found nurses to be associated with more investigations but equal number of prescriptions. However, the review of Horrocks⁶⁶ might be quite out of date compared to the other reviews.

Table 10. Methodological differences with other reviews

<i>Focus of other reviews</i>	<i>Differences with our review</i>				
	No meta-analyses	Includes nurses working as supplements according to our definition	Includes non-randomized studies	Focuses on particular countries	Particular focus on cost outcomes
Bonsall 2008 ⁶⁸ This literature review assesses the impact of advanced primary care nursing roles, particularly first contact nursing roles, for patients, nurses themselves and their colleagues	x	x	x		
Hollinghurst 2006 ⁶⁹ This study used the literature search of Horrocks 2002 and estimates the resource use for a same-day consultation and cost difference of employing an extra salaried GP or NP	x			UK	x
Horrocks 2002 ⁶⁶ This systematic review compares NPs and doctors providing care at first point on patient satisfaction, health status, process measures and quality of care		x	x	Developed countries	
Martinez 2015 ^{10,14-17} Several systematic reviews investigating the effect of nurses working as substitutes for primary care physicians on clinical effectiveness, course of disease, process care, resource utilization and costs		x			
Martin-Misener 2015 ⁶⁷ This systematic review determines the cost-effectiveness of NPs delivering primary and specialised ambulatory care		x			x
Naylor 2010 ⁷⁰ This structured literature review investigates the value of advance practice nurses in delivering primary care, with a particular emphasis on the contributions of NPs	x	x	x		
Newhouse 2011 ⁷¹ This systematic reviews compares patient outcomes of care by advanced practice registered nurses (APRNs) to care by other providers (physicians or teams without APRNs)	x	x	x	US	
Swan 2015 ⁷² This systematic review includes 10 studies evaluating the cost and quality of care provided by APNs in primary care	x				

Lastly, similar to most other reviews, the current review may suggest little or no difference in cost of care between nurse-led care and doctor-led care.^{10,67,69,72} Naylor⁷⁰ and Newhouse⁷¹ indicated that nurse care is associated with lower costs. These difference might be explained by a focus on the United States only,⁷¹ the inclusion of non-randomized trials and a focus on advanced nurses and nurse practitioners.^{70,71} All reviews agree that the evidence of nurse-led care on cost of care is of low quality.

AUTHORS' CONCLUSIONS

Implications for practice

Nurse-doctor substitution in the provision of first contact (including urgent care), ongoing care for all presenting physical complaints, and follow-up of patients with a particular chronic condition has been relatively well evaluated. Nurse-doctor substitution for preventive services and health education has been less well studied.

This review shows that trained nurses, such as nurse practitioners, practice nurses and registered nurses, probably provide equal or better quality of care as primary care doctors and achieve equal or better health outcomes for patients. Nurses tend to provide more health advice and achieve higher levels of patient satisfaction compared with primary care doctors (Table 9).

From this review, we cannot conclude whether it is better to deploy nurses providing care to a broad range of patient complaints or to target groups of patients. Both seem to be possible, with at least equal quality of care.

Furthermore, this review cannot draw conclusions on what nursing education level gives the best outcomes when substituting for doctors. In our review, the educational level of nurses was often unknown and often different nurse roles / types of nurses where included within the study, so we were not able to disentangle this within our review.³

For policymakers it is important to know the financial impact of doctor-nurse substitution. Whether nurse-doctor substitution leads to substantial savings and whether nurse-doctor substitution is cost effective remains unknown. Savings on nurse salaries may be offset by nurses' longer consultation length and rate as compared to doctors (Table 9). On the other hand, nurses adhere better to guideline recommendations and patients better comply to return visits which may positively affect health outcomes and therefore costs on the long-term.

Our review focused on the differences in outcomes between care provided by nurses and care provided by doctors. However, although studies show an independent

practice role for nurses, the quality of the total patient care is determined by the whole primary care team. Only three studies in our review included the impact of nurses on doctor behaviour. Policymakers should be aware that implementing nurses in primary care teams has an influence on the functioning and quality of care delivery by the entire team.

Implications for research

Although this review included a high number of studies, a number of important research questions remain.

The methodological quality of recent studies is still variable. Future studies should seek to maximise the numbers of practitioners, rather than numbers of patients, in order to reduce the effect of any individual practitioner on outcomes. Moreover, for a better insight in the differences in health status, studies with longer follow-up periods are needed. For a full understanding on the impact of nurses in primary health care teams, we need a deeper insight in the functioning of the entire team. Qualitative studies are needed to get insight into the roles of nurses and doctors, for example: How do nurses and doctors work as a team? How do they interact? How are roles and responsibilities defined? How do these agreements affect nurse and doctor behaviour? This also implies a further understanding in the limits of substitution. There is currently a lack of evidence into the most optimal model of collaboration and deployment of doctors and nurses in primary health care teams.

All studies except one, were conducted in high-income countries. It is not clear whether the results can be generalised to low-income countries. Therefore, we need more research from low-income countries. Moreover, there is a lack of insight in the influence of nursing level on the effect of doctor-nurse substitution. Reasons include the lack of international education standardization and insufficient reporting of nursing levels in research papers.

Cost, particularly societal costs, have not been well investigated despite the widely held view that nurse-led care will generate savings. Most studies have major limitations in the cost evaluation. Future studies of nurse-doctor substitution should give more attention to the financial aspects of care, for example in cost-effective analyses. Related to this is the question of what impact nurses have on doctor behaviour and workload. This has been evaluated in only three studies despite the widely held view that nurses can 'save' doctors' time.

In future reviews about doctor-nurse substitution, it is important to realize that health-care services change extensively over time. New treatments and innovations

will affect health-care delivery. Organisational interventions are complex interventions and should be treated in that way to get a well-informed understanding of mechanism and how these impact the outcomes.

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Factors influencing decision of
general practitioners and
managers to train and employ a
nurse practitioner or physician
assistant in primary care: a
qualitative study

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ABSTRACT

Background: Due to the increasing demand on primary care, it is not only debated whether there are enough general practitioners (GPs) to comply with these demands but also whether specific tasks can be performed by other care providers. Although changing the workforce skill mix care by employing Physician Assistants (PAs) and Nurse Practitioners (NPs) has proven to be both effective and safe, the implementation of those professionals differs widely between and within countries. To support policy making regarding PAs/NPs in primary care, the aim of this study is to provide insight into factors influencing the decision of GPs and managers to train and employ a PA/NP within their organisation.

Methods: A qualitative study was conducted in 2014 in which 7 managers of out-of-hours primary care services and 32 GPs who owned a general practice were interviewed. Three main topic areas were covered in the interviews: the decision-making process in the organisation, considerations and arguments to train and employ a PA/NP, and the tasks and responsibilities of a PA/NP.

Results: Employment of PAs/NPs in out-of-hours services was intended to substitute care for minor ailments in order to decrease GPs' caseload or to increase service capacity. Managers formulated long-term planning and role definitions when changing workforce skill mix. Lastly, out-of-hours services experienced difficulties with creating team support among their members regarding the employment of PAs/NPs.

In general practices during office hours, GPs intended both substitution and supplementation for minor ailments and/or target populations through changing the skill mix. Supplementation was aimed at improving quality of care and extending the range of services to patients. The decision-making in general practices was accompanied with little planning and role definition. The willingness to employ PAs/NPs was highly influenced by an employees' motivation to start the master's programme and GPs' prior experience with PAs/NPs. Knowledge about the PA/NP profession and legislations was often lacking.

Conclusions: Role standardisations, long-term political planning and support from professional associations are needed to support policy makers in implementing skill mix in primary care.

BACKGROUND

With an aging population, more patients with chronic complaints and reforms that shift care from hospitals to the community, the pressure on primary care is high.¹⁻³ It is not only debated whether there are enough general practitioners (GPs) to comply these increasing demands but also whether specific tasks can be transferred to other care providers. Changing the health-care workforce skill mix has been applied to improve effectiveness and efficiency of health care.⁴ Around the world, physician assistants and nurse practitioners (PAs/NPs) have been involved in primary care. Although definitions, education and legislation of PAs/NPs differ per country, there is a common ground that PAs/NPs are trained to diagnose and treat defined patient groups (semi-) independently or under physician supervision.^{2,3,5} Research has shown that PAs/NPs can substitute for GPs on a wide range of patient care tasks, resulting in at least comparable outcomes to those of GPs and higher patient satisfaction.^{1,2,6} In addition, PAs/NPs can be involved in specific complementary roles such as preventive care or home visits.^{2,7,8} Nevertheless, the implementation of PAs/NPs differs between and within countries.⁹⁻¹² In the Netherlands, most PAs/NPs work in hospital settings and their implementation in primary care is still at a pioneering stage.^{13,14} The number of PAs/NPs in relation to GPs (headcount) is approximately 1 PA and 2 NPs per 100 GPs.^{15,16}

PAs/NPs have worked in the Netherlands since 2001. The education of PAs/NPs in the Netherlands includes a master's programme of respectively 2.5 and 2 years at universities of applied sciences.¹⁰ Their education incorporates a dual work-education model, meaning that students are employed within a practice and receive salary.¹⁷ Although PAs' education is based on a medical model and NPs' education on a nursing model, the position of PAs and NPs in primary care is often regarded as interchangeable.¹⁸⁻²⁰ In the Netherlands both care providers are allowed to prescribe drugs and perform certain preserved procedures related to diagnosis and treatment independently.^{10,21} However, there is still a lack of clarification regarding their role and value in primary care; a situation observed internationally.^{2,22,23} So far, the Dutch College of General Practitioners (NHG) and National Association of General Practitioners (LHV) have not proposed a role for PAs/NPs in the basic primary care team in general practice.¹⁰

Currently there is limited insight into the reasons to employ, or not to employ, a PA/NP in primary care. Evidence from European countries is lacking or outdated.⁴ To support policy making, more evidence is needed about the reasons and perspectives of GPs and managers to train and employ PAs/NPs in primary care.

METHODS

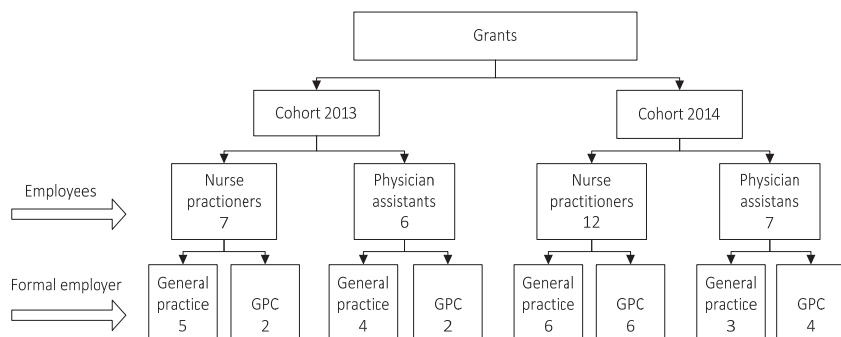
Study aim and design

A qualitative study to provide insight into factors influencing the decision of GPs and managers to train and employ a PA/NP within their organisation.

Setting & cohort

In the Netherlands, GPs are a patient's first point of contact and the 24/7 gatekeepers for secondary care. During office hours, the majority of GPs work in small-scale general practices (eighty percent are duo or solo practices).^{24,25} To deliver out-of-hours care, GPs from a region are organised in general practitioner cooperatives (GPCs). At those GPCs 40 to 250 GPs take turns on being on duty to take care of populations ranging from 100,000 to 500,000 citizens.^{26,27} In 2013 a project was initiated in the Netherlands that offered both general practices and GPCs additional financial support to train a PA/NP within their organisation. PAs/NPs who were formally employed by GPCs were trained during office hours in general practices in the region. Those organisations whose application for financial support was granted were included in the study cohorts. There was no further selection of participants and all organisations were included. The 2013 cohort included 13 PAs/NPs and the 2014 cohort included 19 PAs/NPs who were either formally employed by a general practice or a GPC (see Fig. 1). We included one GP from all general practices where the PAs/NPs received their training during office hours. In addition, in the case that the PA/NP was formally employed at a GPC, we also included a manager of that GPC. Some GPCs employed more than one PA/NP.

Figure 1. Overview study cohort



Data collection

Data were collected between September 2014 and January 2015. As there was a lack of previous knowledge and the topic of PAs/NPs in primary care might be considered controversial, individual semi-structured interviews were chosen to obtain in-depth information about the experiences of the participants. Interviews were conducted either face-to-face at the practice site or by telephone. Three main topic areas were covered in the interviews: determinants of the decision-making process, considerations and arguments to train and employ a PA/NP, and PAs'/NPs' tasks and responsibilities. Each topic area included 3 or 4 open-ended questions to encourage participants to discuss their perspectives and considerations. The interview guide was developed by the primary researcher (MB) with guidance from the co-authors (ML, ED). The interviews were conducted by the primary researcher; a health scientist trained in qualitative research methods. Interviews were audiotaped and then transcribed verbatim.

Data analysis

The transcribed interviews were analysed using content analysis, a qualitative research method to systematically organise data into a structured format.²⁸ First, two researchers (MB, IM) independently coded the transcripts using an inductive approach. Coding was done with constant comparison of interpretations and the generated list of codes was developed into a shared codebook. During face-to-face meetings the codes of the two researchers were discussed until consensus was reached. Next, coding was followed by a collaborative interpretation in which data was mapped into themes and subthemes. Data was declared to have reached saturation when no new themes were emerging. Lastly, these (sub) themes were discussed for framing of the results and the final refinement of the codes and themes was done by the research team (MB, ML). Atlas.ti software V.7.1.5. was used to facilitate the coding process.

RESULTS

Study population

A total of 32 PAs/NPs started their training in general practices in September 2013 or in September 2014. All GPs owning those practices participated in the interviews. Thirteen of the 32 PAs/NPs were formally employed by a GPC. Therefore, a manager from each GPC was interviewed in addition to the interviews with the GPs. Table 1

provides an overview of the interviewees and there were no refusals to participate. General practices and GPCs were situated across the Netherlands. The first six interviews took place at the practice site and all others were conducted by telephone. The mean duration of the interviews was 51 min (SD 12.71). Only 5 GPs had experience working with a PA/NP in their practice prior to the project.

Table 1. Characteristics of interviewees (N = 39)

	N	%
General practitioner solo practice	13	(33.3%)
General practitioner duo practice	8	(20.5%)
General practitioner group practice	11	(28.2%)
Manager general practitioner cooperative	7	(17.9%)
Male	18	(46.2%)
Female	21	(53.8%)
Mean age GPs	48	(SD 8.6)

The analysis resulted in three themes from which 11 categories emerged (see Table 2).

Table 2. Themes and categories influencing the decision of GPs and managers to train and employ a PA/NP

<i>Theme I. Reasons to employ a PA/NP</i>
Substitution of care
Quality improvement
New/ additional services
<i>Theme II. Influencing factors</i>
Organisational factors
Factors regarding professional relations
Factors regarding GPs’ workload and job satisfaction
Experience with the PA/NP profession
Vision about the PA/NP profession
Insecurities regarding the PA/NP profession
<i>Theme III. PAs’/NPs’ tasks and responsibilities</i>
Direct patient care
Indirect or non-patient related tasks

Theme I. Reasons to employ a PA/NP

Three categories emerged from this theme explaining why GPs or GPCs employ a PA/NP: (1) substitution of care; (2) quality improvement; and (3) new/ additional services.

Substitution of care

The main reason for GPs and GPCs to employ a PA/NP was substitution of care. They wanted a professional who is capable and authorised to treat patients independently and take over surgery hours from GPs. This is a response to the increasing workload for GPs due to changes in patient population (e.g. ageing populations, multi-morbidity) and changes in organisation of health care (e.g. task shifts from hospital to primary care and an increase in demand to participate in community projects). Some GPs wanted to employ the PA/NP in order to replace a GP, to expand the number of patients in their practice or to create job opportunities for their own professional development (e.g. focussing on more complex patients, more time for study or ancillary activities). Only one GP indicated a shortage of GPs as a reason to employ a PA/NP.

“The intention is to get more time for the increase in complex problems we have to deal with in the near future. This is the start of an evolution: ageing, substitution, tasks shifts from hospital care to primary care. I expect that GPs will get larger practices and cannot comply with the demand for care without support.”

(GP group practice, employing a PA)

For the GPCs an important determining factor was the opening of an emergency care access point (ECAP) for out-of-hours emergency care. This new model is expected to increase the number of consultations at the GPC resulting in an increase in number of shifts per GP.

“With the opening of a new ECAP we expect an increase in workload that cannot be answered by the GPs in the region. Therefore, we initiated to work with NPs to meet the increase in patients so that GPs can focus on the complex patients.”

(Manager GPC, employing an NP)

Quality improvement

By employing a PA/NP most GPs expected to improve the quality of care provided within their practice. Under quality improvement they mentioned: more continuity of care compared to employing a young doctor (often young doctors start their own practice sooner or later); schedule more time for complex patients; more monitoring of target populations and less waiting time for patients with minor ailments. GPs who employed an NP considered a nursing view complimentary to the medical view of the GP. GPs expected NPs to pursue a mix of cure and care and have better collaboration with other care providers in primary care like community nurses. Other quality improvements are related to new additional services.

“I am experienced with GPs employed by another GP. Yet the downside is that they will leave as soon as they can start their own practice, which causes disturbance among the patients.”

(GP solo practice, employing a PA)

“Looking at the NPs at the GPC, I notice they comply even more to guidelines and bring a nursing view into their considerations that is of added value for patient care.”

(GP group practice, employing an NP)

New/ additional services

Some GPs considered the employment of a PA/NP an opportunity to implement new services within their practices. Most often these services reflect the current policies of the Ministry of Health, Welfare and Sport, health insurance companies and shifts in populations to treat. For example, increasing monitoring of elderly or participating in community projects for preventive care. Some GPs wanted an expansion in care settings for patients such as offering surgery hours in nursing homes or providing hospital care (e.g. diagnostics) in their practices.

“There are machines to measure the COPD condition, which is something that can easily be delegated to a PA. That would be an improvement in patient care and a lower burden for patients who otherwise have to go to the city.”

(GP solo practice, employing a PA)

Quality improvement and new/additional services were not mentioned by GPCs as a reason to employ PAs/NPs.

Theme II. Influencing factors decision-making process

There were several factors influencing the decision to employ a PA/NP. Six categories emerged around this theme: (1) Organisational factors; (2) Factors regarding professional relations; (3) Factors regarding GPs' workload and job satisfaction; (4) GPs' experience with the PA/NP profession; (5) Vision of the PA/NP profession; and (6) Insecurities regarding the PA/NP profession.

Organisational factors

For some GPs financial certainty was an important factor and they let an accountant calculate the financial impact of employing a PA/NP. As a consequence of the implementation of the PA/NP, support staff from practices without prior experience with PAs/NPs needed extra guidance in the triage of patients to the right care provider. Lastly, having a sufficient number of surgery rooms was a precondition for all GPs.

"When you compare practices with GPs only with practices with GPs and NPs, you need a shift in the organisation, for example triage nurses need to decide which patient has to be treated by which care provider."

(GP group practice, employing an NP)

For GPCs, the preparation of implementing a new discipline within the organisation took a lot of effort and had an impact on several departments (e.g. human resources and finances), site managers and support staff. A main issue for GPCs was the fact they offer care out-of-hours. In order to maintain a balanced work-private life, they could only offer small contracts with a maximum of eight hours per week. They therefore rely on general practices' willingness to offer more contract hours to the PA/NP during office hours. However, finding those practices was difficult. GPs often missed the experience and knowledge about PAs/NPs or they criticised their role in primary care. When GPs were positive, a shortage of surgery rooms or financial factors negatively influenced the implementation. Lastly, some GPCs expressed difficulties recruiting PAs/NPs with the proper preliminary training and/or experience, or with a supportive home situation.

"It is very hard to find GPs who are willing to offer work during office hours. Often the preconditions cannot be met; not enough surgery rooms, colleagues are not supportive, finances don't fully cover, 'we already have so many employees in our practice'. We have heard all of these arguments before."

(Manager GPC, employing an NP)

Factors regarding professional relations

For most GPs the primary motive to employ a PA/NP was either a willingness to meet the concerns of GPCs by offering the PA/NP a job opportunity during office hours, or maintaining an appreciated team member. Most often this team member was a practice nurse who already worked within the practice and had the ambition to expand his or her nursing practice by becoming a PA or NP. GPs wanted to meet this ambition in order to keep this employee for their practice. Support among their staff was for almost all GPs a requirement to employ a PA/NP. Another precondition was sometimes the collaboration with another practice.

“The PA training was the choice of the PA herself, whereas for me an important factor to approve the training was losing her as an employee if I wouldn’t have provided her the opportunity.”

(GP solo practice, employing a PA)

For GPCs decisions are made by a management team in consultation with the members council (i.e. GPs who own practices in the region). Creating a support base for the employment of PAs/NPs with their members was therefore of great importance and very time consuming. GPCs experienced that the negative viewpoint of the professional associations made GPs reluctant to employ a PA/NP in their practices during office hours.

“You can say, there is no support from GPs’ professional associations for the position of PAs in general practices. That makes GPs hesitant to include this profession within their own ranks.”

(Manager GPC, employing a PA)

Factors regarding GPs’ workload and job satisfaction

As a consequence of the PA/NP treating the less complex patients, all GPs expected a difference in their own caseload. While some GPs considered this an opportunity for their own professional growth and enhancing job satisfaction, others feared a more complex caseload. This included a fear of losing routine in treating minor ailments or an increased work pressure due to more complex complaints during surgery hours. Some GPs expected difficulties in taking proper responsibility for their patients and feared missing out on things in case the PA/NP takes over patient care. Detailed knowledge about the Dutch legislation regarding PAs/NPs was often lacking.

“Look, you delegate a great part of the care. That means you partly lose sight. But the same would happen were you to employ another GP.”

(GP solo practice, employing an NP)

“Maybe a disadvantage is a transformation in GPs’ surgery hours in case the number of low complexity problems decreases and the majority of problems become highly complex.”

(GP group practice, employing an NP)

GPs’ experience with the PA/NP profession

Some GPs previously worked together with a PA/NP, either at a GPC or in a foreign country, which positively influenced their decision to employ a PA/NP. Also positive experiences of colleagues influenced the decision. However, due to the small number of PAs/NPs in primary care in the Netherlands not many GPs had experience with them or knew a colleague with a PA/NP and they made little effort to get in contact with any colleague.

“We experienced working together with NPs at the GPC and my colleague and I were very satisfied with their functioning. That made us curious how it would work out in our practice.”

(GP group practice, employing an NP)

“I am always eager to innovate, so I thought “why not?”. This was also because I had heard from a colleague that they are really happy with their physician assistant.”

(GP solo practice, employing an NP)

Vision of the PA/NP profession

In general, GPs had a lack of knowledge regarding the differences between the PA and the NP professions. They often did not know the differences in education and scope of practice. The choice to employ either a PA or an NP was mostly the training preference of the applicant. Some GPs had let themselves be informed by the Foundation for Development of Quality Care in General Practice and one GP made his decision based on scientific literature. GPs considered the PA to be more medically educated and the NP to be more connected with care in general. There were also inaccuracies expressed, for example the belief that a nurse could not apply for a PA training. GPs who employed a PA did not express much preference regarding previous professional

experience and preliminary training. The majority of GPs employing an NP considered a nursing education required to treat the broad spectrum of complaints in primary care. Moreover, they often considered nursing experience in several clinical hospital departments to be favourable.

In many cases curiosity played a role in the decision to employ a PA/NP and preparation of the implementation was often lacking. Most GPs did not have a clear insight in the role of PAs/NPs in other primary care practices or in the exact curriculum of the training. A clear long-term vision about the role of the PA/NP in their practice was often not expressed.

"I should really revisit the differences between a PA and an NP, because for me those definitions somewhat overlap. So, no, we didn't really discuss or look at which professional we would employ."

(GP group practice, employing an NP)

"We started without good preparation or a detailed plan about what we exactly wanted to achieve in the long term. How do we want to shape our practice? We weren't sufficiently aware about how the profession in general practices works."

(GP group practice, employing an NP)

"The single-handed GP like it used to be is something that is slowly changing and completely disappearing. Now you are building a team within general practices. Maybe it should be called primary care team, in which many professionals collaborate in one centre, with the common goal of improving health care in the broadest sense. The GP has a role, just as NPs do. It's the team that puts it together."

(GP group practice, employing an NP)

In contrast to GPs, GPCs made more informed decisions regarding the employment of a PA or an NP. This was often based on the curriculum of the training or preferences of the GPs in their region. They often formulated a long-term vision of the PA's/NP's role within their organisation.

Insecurities regarding the PA/NP profession

GPs without prior experience working with PAs/NPs expressed uncertainties about their own profession, in particular that an actual decrease in their workload is not guaranteed. Almost all GPs expressed uncertainties about the future in terms of the

financial reimbursement of primary care and about political decisions regarding legislation and scope of practice of PAs/NPs.

Both GPs and GPCs felt that political and financial uncertainties made it difficult to formulate long-term organisation planning. Moreover, investments in the training and employment of a PA/NP cause uncertainties because there is no guarantee that these will be paid back.

“Rules keep on changing during the play. Planning ahead and ensuring a financial base is difficult as there are no certainties in general practice.”

(GP duo practice, employing an NP)

Theme III. PAs’/NPs’ tasks and responsibilities

Direct patient care

Most GPs had not formulated an exact role description including the scope of PA’s/NP’s practice and GPs differed considerably in their ideas about the task of the PA/NP within their practice. Some GPs wanted the PA/NP to serve certain target populations, while others wanted the PA/NP to serve a broad range of patient complaints. Different views were expressed as to whether or not PAs/NPs should treat chronic patients, acute problems, palliative care, gynaecology complaints and care for elderly or young children. In general, there were some complaints that all GPs agreed were suitable for PA/NP practice. These minor ailments included: dermatology, ear nose and throat complaints, musculoskeletal system and influenza. In addition, preventive tasks like social home visits and postoperative consultations were considered suitable. GPs considered complaints to be suitable when they are not life threatening and if there is a low impact when something goes wrong. The role description was based on the curriculum of PA’s/NP’s training, experience of the PA/NP, the number of patients having those complaints, and being straightforward for triage.

“We wanted a professional who could take over parts of our job. For example, we were thinking about ear complaints, children with fever, abdominal pain, urological infections, et cetera. So, well defined areas that are straightforward for triage.”

(GP duo practice, employing a PA)

“In palliative care, a lot of tasks are not medical based, but rather nurse based. We intend the NP to be responsible for organising everything at home when a patient is discharged from the hospital; keeping everyone informed about agreements and having insight in expected complications.”

(GP group practice, employing an NP)

In contrast to the general practices, the GPCs formulated a role description for the PA/NP for the shifts at the GPC. This role description included a number of complaints that were excluded from PA/NP care, all other complaints were considered within PAs’/NPs’ scope of practice. At most GPCs those complaints were: abdominal pain, cardiological, neurological and psychiatric complaints and children younger than 1 year old. GPs who trained the PAs/NPs who were employed by the GPC, were free to make decisions on PAs’/NPs’ tasks within their practices during office hours. In practice, they usually used the same role description as the GPC.

Indirect or non-patient related tasks

In general, both GPs and GPCs had not considered indirect or non-patient related tasks much. They wanted the PA/NP to focus on direct patient care first. Indirect or non-patient related tasks were likely to be considered when the PA/NP would be more experienced. Tasks considered suitable were: meetings with other primary care professionals, coordination of elderly care, developing protocols and training support staff.

“Of course the PA can participate in projects like quality improvement, practice accreditation, but we don’t really know exactly yet, we’ll just see.”

(GP group practice, employing a PA)

DISCUSSION

Employing PAs/NPs in general practices requires role revision. The literature describes two conceptually different approaches to role revision. The first is to employ PAs/NPs as substitutes for GPs, the second as supplements.³ The GPCs in the current study primarily aim at substitution of GPs within teams offering out-of-hours care. That means PAs/NPs provide the same services as GPs in order to decrease GPs’ caseload or increase service capacity as a reaction to the increased workload due to the opening of ECAPs. General practices on the other hand, do not just aim at substitution but also at supplementing GPs. The aim of supplementing is to improve quality of care and extend the range of services to patients. By extending the range of services GPs are

able to meet the increase in tasks and patient groups in primary care.³ An extension in services is also considered a quality improvement. In addition, GPs consider the added value of PAs/NPs as a quality improvement. The services provided by PAs/NPs are considered less medically focussed and instead, often based on their orientation in the nursing discipline, have a more holistic focus.²² Both GPCs and GPs consider care for patients with minor ailments to be within a broad spectrum suitable for PA/NP care. Some GPs also employ PAs/NPs for certain target populations either as substitute or supplementary to GPs. A study about PAs as case managers for geriatric conditions, suggests that incorporating PAs in supplemental roles for target populations can increase quality of care for previously underdiagnosed and undertreated conditions.²

According to Contandriopoulos et al.²⁹ several themes are important for an effective model for integrating new roles in primary health-care teams. These themes include planning, role definition, practice model, collaboration and team support. The GPCs in the current study put a lot of effort into advance planning. They developed a comprehensive plan and formalised the role of the PA/NP in writing. Moreover, they expressed a clear vision on how the practice model of PAs/NPs in teams together with GPs provides out-of-hours care. In larger organisations like GPCs this clear role formalisation is especially important.²⁹ Although GPCs put a lot of effort into creating support among their members, due to the large number of members, not all members were supportive about implementing PAs/NPs. As a result, GPCs experience uncertainties about their financial investment in PAs/NPs because GPCs highly depend on general practices to provide the PAs/NPs employment during office hours. Influencing factors, also shown in the literature, for the negative viewpoint among GPs are the lack of support from GPs' professional associations or not being convinced of the added value of PAs/NPs in primary care.³⁰⁻³²

The implementation process in general practices differs from GPCs. International studies have shown that inadequate planning is very common for general practices.^{33,34} General practices are understood as complex responsive processes of humans relating to each other. GPs do not usually develop a blueprint for the change that comes with the PA/NP role in their practice. However decisions are not simply random either.³⁵ As Contandriopoulos et al.²⁹ describe "integrating NPs into primary care teams is likely to be a dynamic, complex, and messy process". Decisions emerge in the interplay of intentions, communicative gestures and responses, power-relating and values-based choices and actions of the partners, practice staff and policy makers in a range of areas.³⁵ In the current study the determining factors to employ a PA/NP were often: 1. an employee who wanted to start the PA or NP master's programme, or 2. GPs wanting to support the GPC by providing employment and training to the

PA/NP during office hours. Just as in previous studies, most GPs expressed that their willingness to employ a PA/NP was influenced by prior knowledge or working experience with PAs/NPs.^{4,30,36} However, knowledge about the PA/NP profession, legislation and role definitions in general practice is often lacking. Just as in other studies there are preconceived notions about PAs'/NPs' roles and training and the difference between a PA and an NP is not clear.^{30,37,38} GPs from practices without prior experience working with PAs/NPs felt hesitant about the changes in caseload and whether their workload actually decreases when they employ a PA/NP. Their hesitance can be supported by literature showing that employing PAs/NPs does not always result in a reduced workload, especially when the GP continues to provide the care that has been substituted. Moreover, with the employment of PAs/NPs the complexity of patients for GPs increases.^{2,4,39} The development of the practice model is, as previously observed in other studies, often emerging through trial and error. GPs base their vision on the needs of their patient population and the experience and preferences of themselves and the PAs/NPs.^{2,29} In addition, the roles of the PAs/NPs are often not well defined. Although many studies indicate an inappropriate and incoherent definition of the PA/NP scope of practice as a big obstacle for PA/NP integration, this does not necessarily mean that roles should be formalised in writing (which is especially the case for small practices). Instead role formalisation should preferably be flexible and allow team members' practices to evolve.²⁹ Lastly, GPs rarely expressed problems in collaboration and creating team support regarding the employment of a PA/NP.

As there is a lack of international defined role standards and clarity, each organisation formulates its own scope of practice. International standardisation of PA/NP roles can resolve some of the confusion perceived by other professionals and would enable PAs/NPs to practice to their potential.^{12,30,40} Moreover, like the GPs in the current study indicate, it is important that political decisions and finances regarding the PA/NP profession in the future are clear and transparent.^{23,41}

Strengths and limitations

The current study has several limitations. First, only GPs and GPCs who had already decided to train and employ PAs/NPs were included in the study. Therefore a comprehensive overview in barriers perceived by GPs and GPCs who decide not to employ PAs/NPs cannot be given. Moreover, the role of the PA/NP in primary care is still at a pioneering stage in the Netherlands and the implementation might be different when PAs/NPs are more widespread. However, the stage of PA/NP

implementation differs a lot between countries and so the current study gives a broad overview about implementation by the early adaptors in the field.

Not all findings were found across all practices or participants. The main variation was found between GPCs and general practices. We did not find variation between practices employing a PA or an NP, confirming that PAs and NPs are often regarded as interchangeable in primary care.^{18,19} Some outcomes, such as how a change in caseload for GPs was perceived, differed considerably between individuals. Lastly, there were few practices that had prior experience with a PA/NP within their practice. As most outcomes did not differ for practices without prior experience then these practices were not treated as a separate subgroup.

A strength of the current study is the large number of interviews. Participants were from a broad geographical area and the variation in type of practices reflects the distribution of practices in the Netherlands.²⁵ Second, interviews were conducted in a semi-structured manner with open coding, which allowed researchers to preserve all information. A potential limitation might be that the setting of interviews was not identical. The majority of the interviews were conducted by telephone, which allowed the researchers to include practices across the entire country. We did not experience differences between the face-to-face and telephone interviews that could have caused data loss or distortion and this is supported by literature on qualitative research interviews.⁴²

It should be noted that the current study indicates several themes that influenced implementation of the PA/NP in Dutch general practice. It is difficult to translate these to county-specific characteristics due to differences in PA/NP autonomy, PAs'/NPs' level of education and differences in health-care systems.^{17,31,43} Moreover, there is a lack of international and national role standardisation and the implementation of PAs/NPs differs between and within countries.⁹⁻¹² In contrast to countries like the United Kingdom, United States, Canada and Australia, the PA/NP role in primary care is relatively new in many countries (including the Netherlands) or non-existent.^{22,43} However, countries with large numbers of PAs/NPs in primary care also struggle with role clarifications and authorities.²² Further research is therefore needed about the roles and the implementation of PAs/NPs from different countries.^{5,11}

CONCLUSION

The current study considerably improves our understanding of the factors influencing the decision to employ PAs/NPs in primary care. GPCs intended substitution of care of minor ailments and formulated long-term planning and role definitions. They experienced difficulties with creating team support. In general practices, GPs intended both substitution and supplementation of GPs for minor ailments and/or target populations. The decision-making in general practices was a dynamic process with less planning and role definition. Although roles should be able to evolve over time, a comprehensive long-term practice planning is advisable. Role standardisations, long-term political planning and support from professional associations are needed to support policy makers in implementing PAs/NPs in primary care.

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Substitution of general
practitioners by nurse
practitioners in out-of-hours
primary care: a quasi
experimental study

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ABSTRACT

Aim: To provide insight into the impact of substituting general practitioners with nurse practitioners in out-of-hours services on: (1) the number of patients; and (2) general practitioners' caseload (patient characteristics, urgency levels, types of complaints).

Background: General practitioners' workload during out-of-hours care is high, and the number of hours they work out-of-hours has increased, which raises concerns about maintaining quality of care. One response to these challenges is shifting care to nurse practitioners.

Design: Quasi-experimental study comparing differences between and within out-of-hours teams: experimental, one nurse practitioner and four general practitioners; control, five general practitioners.

Methods: Data of 12,092 patients from one general practitioners cooperative were extracted from medical records between April 2011 and July 2012.

Results: The number of patients was similar in the two study arms. In the experimental arm, the nurse practitioner saw on average 16.3% of the patients and each general practitioner on average 20.9% of the patients. General practitioners treated more older patients; higher urgency levels; and digestive, cardiovascular and neurological complaints. Nurse practitioners treated more patients with skin and respiratory complaints. Substitution did not lead to a meaningful increase of general practitioners' caseload.

Conclusion: The results show that nurse practitioners can make a valuable contribution to patient care during out-of-hours. The patients managed and care provided by them is roughly the same as general practitioners. In areas with a shortage of general practitioners, administrators could consider employing nurses who are competent to independently treat patients with a broad range of complaints to offer timely care to patients with acute problems.

INTRODUCTION

In the last decade, out-of-hours primary care has been reorganized in several Western countries in response to various challenges. These include a shortage of general practitioners (GPs), reduced motivation to provide 24/7 care and the increased number of primary care contacts taking place out-of-hours.^{1,2} The workload for GPs during out-of-hours care is high, and the number of hours GPs work has increased. This raises concerns about maintaining quality of care. One possible response to these challenges is shifting care from GPs to nurse practitioners (NPs). NPs have demonstrated their ability to do part of GPs' work in daytime primary care. NPs have the knowledge, competencies and complex decision-making skills for an expanded practice.³⁻⁶ However, the implications of substitution in an out-of-hours service are unknown. Is it possible to substitute a GP with an NP in a team of GPs and what is the effect on the number and characteristics of patients (i.e. caseload) of the other GPs? This study contributes to the evidence base of substitution of care by nurses, with a particular focus on out-of-hours care.

Background

Many Western countries are seeking an efficient and safe model to deliver out-of-hours health care for patients. In the Netherlands, United Kingdom and Denmark, the most common model for delivering out-of-hours primary care is large-scale General Practitioners Cooperatives (GPCs).² In other countries, such as Germany, large-scale services are currently emerging. In the Netherlands, 40-250 GPs, depending on the number of patients in the region, take turns at being on duty from 5 pm - 8 am on weekdays and the entire weekend. They take care of populations ranging from 100,000 - 500,000 citizens. This model of care has many positive aspects,⁷ but it still struggles to comply with the rising demand for out-of-hours care.⁸ This demand is increasing internationally in both out-of-hours primary care and the emergency department (ED).^{7,9,10}

Due to the rising demand for out-of-hours primary care and the anticipated future shortage of GPs, the pressure on GPs is expected to increase even more during the next few years.¹¹ If nothing is done, issues concerning the quality, accessibility and efficiency of out-of-hours care are inevitable. Since most consultations during out-of-hours are neither complex nor urgent,^{8,12,13} shifting care from GPs to nurses is one solution being considered to address these challenges.^{3,14,15} Deploying NPs as professional substitutes for GPs is also interesting since it enhances opportunities for education and job opportunities for nurses. This might improve retention for the nursing.¹⁶⁻¹⁸ The deployment of NPs in primary care is observed internationally, but

the speed of the process differs between countries and sometimes even between states and regions.^{6,11,19}

Research on NPs in daytime primary care shows they can substitute for a GP in the management of patients with minor health problems and that both disciplines provide comparable care.^{3,4,15} Although the number of rigorous evaluations remains low, systematic reviews suggest that doctor–nurse substitution in primary care is associated with higher patient satisfaction, lower overall mortality and fewer hospital admissions. Nurse-led care has proven to be both effective and safe, although not necessarily less expensive.^{3,15,20} In addition, research in emergency care shows that NPs provide a valuable, safe and effective service.^{21–23}

Despite these studies, questions remain about whether and for what kind of care an NP can substitute for a GP in an out-of-hours primary care setting. Although the numbers of NPs working in (out-of-hours) primary care are low in most countries, there are also (mostly rural) regions where the NP is the primary source for patient care.^{11,24} Evidence about the deployment of NPs in out-of-hours is lacking. Whereas during daytime patients more often present chronic complaints, patients during out-of-hours more often present acute problems and infectious diseases.²⁵ Not only is research important because out-of-hours care differs from care during daytime but also because the competencies of NPs are not well defined in most countries. Roles are usually based on education, scope of practice and complexity of complaints and differ between countries, between states or regions, and between organizations.^{18,26,27} For example in the Netherlands and 12 other European and Anglo-Saxon countries, there is a legal basis for independent prescribing of medication and other procedures by NPs. However, authorities differ from prescribing independently to prescribing only under strict conditions and the supervision of physicians.^{28–30} Despite the international differences in scope of practice of NPs, we need more insight into the possibilities of substituting GPs with an NP in out-of-hours primary care and the implications of this model of health-care delivery so that the further implementation of NP roles can be guided appropriately.

THE STUDY

Aims

The aim of this study was to assess the effects of substitution of care from GPs to NPs in an out-of-hours primary care setting. We looked at the number of patients treated at the GPC when in a team of five GPs one GP was substituted by an NP. Our focus was the number of patients treated by the NP. We documented the type of patients that

were treated, to what extent they matched the predefined scope of the NPs' competencies (see Box 1) and the impact on GPs' caseload.

Box 1. Predefined scope of NP care

Excluded from NP care:

- Patients younger than one year old;
- patients suffering from psychiatric complaints;
- patients suffering abdominal pain, chest pain, neck ailment, headache, or dizziness.

Patients that fit the predefined scope of NP care:

All patients with other complaints and ages; not meeting 1 or more of the excluded criteria.

Design

A quasi-experimental study was conducted at a general practitioners cooperative (GPC) in the southeast of the Netherlands.³¹ In the experimental arm, a team of one NP and four GPs provided patient care, whereby the NP substituted one GP. In the control arm, patient care was provided as usual by a team of five GPs. The unit of allocation was weekend days between 10 am and 5 pm. The experimental and control days were determined in advance and followed a 5-week rotation scheme. Days rotated between Saturday and Sunday to avoid bias due to possible differences in patient presentations on those weekend days.

Sample/participants

Patients

All patients who received a consultation at the GPC during the data collection period were included in the study. The explorative character of the study made it difficult to predict the consequences, and so a sample size was not calculated. To obtain reasonably accurate estimates, a 15-month follow-up period was chosen to acquire a sufficiently large sample. Patients were unaware of experimental or control days when they contacted the GPC (blinding).

In both the experimental and the control arm, up to four patients were scheduled every 10 minutes in the common presentation list.³² This was done either by the triage nurses at the call centre or at the front office of the GPC. Patient allocation in the experimental arm to either a GP or NP did not occur randomly or blindly because the professionals chose their own patients from the presentation list based on the

complaints presented. Random allocation of patients to an NP or a GP would have interfered with the daily routine.

Based on the curriculum of the educational training of the five registered NPs, the GPC decided to exclude certain patients from NP care. These included patients younger than 1 year old and patients suffering from psychiatric complaints, abdominal pain, chest pain, a neck ailment, headache or dizziness. All other complaints and ages fell within the predefined scope of NP practice. NPs primarily chose patients from the common presentation list based on complaints they were authorized to treat without GP supervision.

Nurse practitioners

Five NPs were recruited for the study. They had all followed a 2-year master's programme called 'higher professional education master's degree in advanced nursing practice' (MANP). Their programme included an academic course on treating common complaints in primary care and an internship in general practice.^{4,11}

At the beginning of the study, all the NPs had at least 5-year experience working as a licensed NP but no experience in working at the GPC. To ensure their competency to work in out-of-hours care, prior to the intervention, the NPs received three and half days of additional training in the diagnosis and treatment of eye disorders, musculoskeletal disorders (such as fractures, bruises and sprains) and wound care (e.g. suturing). These disorders are not commonly presented during daytime practice and were not part of their master's programme. Finally, the NPs had 1 day of introduction at the GPC during which they worked directly with a GP.

During the shift, the NPs used the same examination rooms as the GPs. Moreover, the supporting staff per team (one receptionist and one medical assistant) was equal in the two arms and for the NP and GPs. In both arms, one GP was indicated as the first point of contact. Before the start of each shift, the NPs made arrangements with this GP for possible consultation about patients.

General practitioners

One hundred thirty-eight GPs were employed at the GPC where the study was conducted. Their mean age was 49.3 years (SD 9); 60% were male and on an average, the GPs had been associated with the GPC for 7.3 years (SD 3.7). Nearly all of the GPs owned or worked at a practice in the region where the out-of-hours care was provided. Both the GPs and the NPs received a fixed tariff per hour for working at the

GPC. The GPs received a compensation from the GPC, whereas the NPs received a salary since they were employed by the GPC.

The GPs were randomly assigned to the weekend days. The scheduling was done by employees at the head office who are in charge of scheduling professionals for several GPCs. They were not familiar with the GPs and did not have any conflicting interests. Working on an experimental and/or control day was based on the availability of GPs. The availability of GPs was indicated by the GPs themselves, but they did not know beforehand whether they would work with an NP at the time of scheduling (blinding).

Measures

Outcomes

The primary outcome was substitution of care, operationalized as the number of patients that had a consultation at the GPC, focusing on the number of patients seen by the NP. A lack of difference in number of patients seen was considered to be indicative of successful substitution of one GP by one NP during the shift. Moreover, patients' characteristics (i.e. age, gender, type of complaint and urgency level) seen in the experimental arm were compared with those in the control arm and the same characteristics were compared between the two professionals in the experimental arm. Finally, the study assessed how many patients matched the predefined scope of NP practice and whether and how GPs' caseload was affected by the introduction of NPs. The GPs' caseload was operationalized as patients' age, gender, type of complaint and urgency level.

Electronic medical records

Data were extracted from the electronic medical records at the GPC during a 15-month period (between April 2011 – July 2012). These data included the following patient characteristics: age, gender, type of complaint and urgency level. Type of complaint was allocated by the GP or NP during consultation, indicated as an International Classification Primary Care (ICPC) code.³³ As Table 1 illustrates, the urgency level of the complaint could vary from U1 to U5.³⁴ The level was allocated either by the nurse triagists at the call centre or at the desk of the GPC.³¹

Table 1. NTS Urgency levels ³⁴

<p>Urgency level 1 (U1) – Life threatening:</p> <p>Immediate action required, the vital functions are threatened or delaying treatment will cause serious and irreparable damage to the patient’s health.</p>
<p>Urgency level 2 (U2) – Emergent:</p> <p>Vital functions are not (yet) in danger, but there is a fair change that the patient’s condition will soon deteriorate or delaying treatment will cause serious and irreparable damage to the patient’s health. Take action as soon as possible.</p>
<p>Urgency level 3 (U3) – Urgent:</p> <p>Do not postpone too long. Treat within a few hours because of medical- or humane reasons.</p>
<p>Urgency level 4 (U4) – Non-urgent:</p> <p>There is no pressure resulting from medical- or other grounds. Time and place of treatment should be discussed with the patient.</p>
<p>Urgency level 5 (U5) – Advice:</p> <p>A physical examination can wait until the next day.</p>

Ethical considerations

The medical ethics committee of the university medical centre waived approval (CMO-nr 2010/465). Confidentiality was assured through exercising professional ethical codes of conduct, whereby all patients were assured that data cannot lead to any identification.

Data analysis

First, descriptive statistics (i.e. frequencies) were used to calculate the number of patients. The number of patients was calculated for the experimental and control arm, as well as for the GPs and NPs in the experimental arm.

Second, to characterize patients seen in the experimental and control arm, descriptive statistics were used for patients’ age, gender, urgency level and type of complaint (ICPC). Differences between both days were tested using a χ^2 -test for categorical data.

The same analyses were performed to compare patient characteristics between NPs and GPs in the experimental arm.

Last, analyses were performed to gain more insight into the impact of substitution on GPs' caseload. For that purpose, patient characteristics between GPs in the experimental arm were compared with GPs in the control arm, using a χ^2 test. The Bonferroni correction was used to counteract multiple comparisons. As four outcome measures were tested against three predictors, a Bonferroni-adjusted significance level of 0.0042 was calculated to account for the increased possibility of type I error. Moreover, the percentage of patients who were excluded from being seen by an NP (ICPC groups: digestive, neurological, psychological, (parts of) cardiovascular and patients younger than 1 year old) was calculated in both groups. Differences between these excluded patients seen by GPs in the experimental arm and the control arm were tested in a logistic regression analysis corrected for weekend day (i.e. Saturday and Sunday). In addition, the number of patients who fitted the predefined scope of the NP was calculated. The statistical analyses were carried out using SPSS software version 20 (SPSS Inc, Chicago, IL, USA).

Validity and reliability

Data collection

A retrospective medical record review was performed to obtain patient characteristics and information about the consultations. All data related to the care and diagnostics were registered by the health-care providers themselves during the consultation. This registration of diagnosis and treatment activities in the medical record was comparable to those of other medical records that are considered to be valid and reliable.^{35,36}

Data analysis

During analysis, two researchers independently checked the allocation of weekend days to either the experimental or control arm. Next, the teams working in the two arms were checked for satisfying the research protocol. Teams with less than five professionals were excluded from the study. The experimental arm included 34 Saturdays and 29 Sundays (63 experimental days) and the control arm included 29 Saturdays and 34 Sundays (63 control days). To prevent potential bias, two Saturdays and two Sundays were excluded from further analysis because the number of professionals working on those days did not meet the study criteria. We investigated

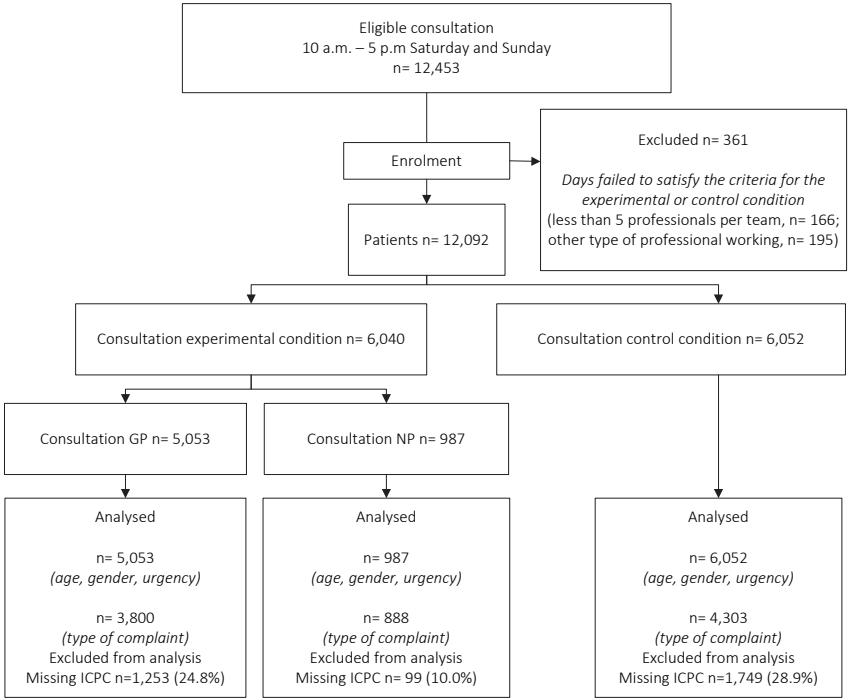
the origin of missing values in the medical records to indicate the potential kind of bias.

RESULTS

Recruitment

All presenting patients during the study period were included in the analyses. The study participants ranged in age from 0 to 100 years (mean = 34.0 SD 24.7) and 47% were male. A total of 3101 cases (10.0% with an NP; 27.0% with a GP) could not be analysed for type of complaint due to a missing ICPC code. A flowchart of the study is shown in Figure 1.

Figure 1. Flowchart of the study



Outcomes

Number of patients

In total, 12,092 patients had a consultation during the study period. In the experimental arm, 987 patients visited an NP and 5053 patients visited a team of four GPs. In the control arm, 6052 patients visited a team of five GPs. This shows that in the experimental arm, the NP saw 16.3% of the attending patients, whereas the four GPs saw on average 20.9% of the patients each. This implies 15.7 patients per NP vs. 20.1 patients per GP on experimental days. On control days, GPs treated on average 19.2 patients each.

Comparison of patient characteristics

Table 2 shows the characteristics of patients seen in the experimental and the control arm and per type of care provider in the experimental arm. Patient characteristics in the experimental and the control arm were comparable; no significant differences were found. In both arms, most patients (>86%) had an urgency level of U3 or U4. More than 55% of the patients suffered complaints of the skin, musculoskeletal or respiratory system.

In the experimental arm, significant differences were found between GPs and NPs for age ($P = 0.002$), urgency level ($P < 0.001$) and type of complaint ($P < 0.001$). There were more patients aged 2-17 years in the NP group and more patients older than 64 years in the GP group. Moreover, GPs in the experimental arm saw a larger proportion of patients with complaints at an urgency level of U2, whereas the proportion of patients with an urgency level of U4 was higher in the NP group. Finally, in the NP group, more patients had skin and respiratory complaints than in the GP group. In the GP group, there were more patients with eye, digestive, cardiovascular or neurological complaints.

Impact on GPs' caseload and number of patients who fit the scope of NP practice

As shown in Table 2, no significant differences were found in patient characteristics between GPs in the experimental arm and GPs in the control arm. Table 3 shows that in both arms, roughly 77.5% of patients fitted the predefined scope of the NP. Consequently, 25.1% of GPs' patients in the experimental arm were patients with a complaint that was excluded for NP care, compared with 22.7% in the control arm ($P < 0.001$) (Table 4). Results from Table 2 indicate that NPs did occasionally see patients excluded for NP care, like digestive (3.0%), psychological (0.5%) and neurological complaints (0.3%) and children younger than 1 year old (7.3%).

Table 2. Characteristics of patients seen by nurse practitioners (NPs) and general practitioners (GPs)

	<i>Control arm (n= 6,052)</i>	<i>Experimental arm (n= 6,040)</i>	<i>GP Experimental arm (n= 5,053)</i>	<i>NP Experimental arm (n= 987)</i>
Age (mean years [SD])	34.02 (24.4)	33.99 (24.94)	34.33 (25.1)	32.25 (23.9)
Age in categories (%)*				
0-1 year	8.2	8.7	9.0	7.3
2-17 years	21.6	21.6	22.3	25.6
18-64 years	56.4	54.1	53.8	55.6
65 years and older	13.9	14.4	15.0	11.4
Gender (% male)	46.4	47.6	46.9	51.4
Urgency (%)*				
U1	0.1	0.1	0.1	0.0
U2	7.9	8.4	9.5	2.4
U3	48.2	47.3	47.4	47.0
U4	38.4	38.7	37.6	44.4
U5	5.4	5.5	5.4	6.2
	<i>Control arm (n= 4,303)</i>	<i>Experimental arm (n= 4,688)</i>	<i>GP Experimental arm (n= 3,800)</i>	<i>NP Experimental arm (n= 888)</i>
Complaints (%)*				
Skin	21.7	22.7	20.7	31.2
Musculoskeletal	20.5	20.1	19.6	22.2
Respiratory	15.2	14.2	13.7	16.3
Ear	5.7	5.8	5.6	6.8
General and unspecified	5.9	6.5	6.6	6.0
Urological	5.5	5.7	5.7	5.6
Eye	6.0	6.1	6.5	4.4
Female genital	1.0	1.0	1.1	0.8
Pregnancy, Childbearing, Family Planning	0.7	0.6	0.6	0.7
Male genital	0.6	0.8	0.9	0.6
Endocrine/Metabolic and Nutritional	0.6	0.7	0.7	0.5
Social problems	0.2	0.2	0.2	0.3
Blood, Blood forming organs and Immune mechanism	0.3	0.2	0.2	0.2
Digestive	10.5	9.9	11.4	3.0
Cardiovascular	2.5	2.5	2.9	0.7
Psychological	0.9	0.7	0.8	0.5
Neurological	2.3	2.3	2.8	0.3

Tested using a Chi²-test, Bonferroni-adjusted significance level of 0.0042.

*significant difference GP experimental arm - NP experimental arm. Other comparisons were not significant.

Table 3. Total number of patients that fit the predefined scope of nurse practitioners’ (NPs) care in the experimental and control arm*

	<i>Patients that fit the predefined scope of NP care</i>	
	Yes (n (%))	No (n (%))
Experimental arm (n=4,688)	3,638 (77.6%)	1,050 (22.4%)
Control arm (n=4,303)	3,326 (77.3%)	977 (22.7%)

Tested within a logistic regression analysis corrected for weekend day

* No significant differences found

Table 4. Patients excluded from nurse practitioners’ (NPs) care who were seen by general practitioners (GPs) in the experimental and control arm

	<i>Patients excluded from NP care*</i>	
	Yes (n (%))	No (n (%))
GP experimental arm (n=3,800)	952 (25.1%)	2,848 (74.9%)
GP control arm (n=4,303)	977 (22.7%)	3,326 (77.3%)

Tested within a logistic regression analysis corrected for weekend day

* Significant difference between GP experimental arm and GP control arm (p <0.001)

DISCUSSION

First, we found no effect of substitution on the number of patients attending the GPC. We found that GPs in the experimental arm each saw slightly more patients than the NPs did. Although this might be due to the predefined scope of the NPs, longer consultation times for NPs is in line with previous studies both in primary care and the ED.^{4,37-39} Consequently, the GPs in the experimental arm saw slightly more patients than GPs in the control arm, although due to the small number this did not affect GPs’ workload. This difference in number of patients may become more relevant when the ratio GP–NP changes.

As expected, we found that in the experimental arm patients seen by NPs demonstrated somewhat different complaints from those seen by GPs. Patients who visited an NP more frequently presented skin, musculoskeletal or respiratory complaints. Patients younger than 1 year or older than 64 years and patients with eye, neurological, digestive or cardiovascular complaints were more frequently seen by a GP. These differences are explained given the fact that older patients and the patients in the ICPC groups ‘neurological’, ‘digestive’ and ‘cardiovascular’ more often present complaints of abdominal pain, chest pain, a neck ailment, headache or dizziness, which were excluded from NP care. Occasionally, the NP treated patients suffering from the excluded complaints. Reasons to explain this practice may include the initial complaint differing from the actual ICPC code, for example, due to an inappropriate telephone

triage,⁴⁰ or the NP having experience with a certain patient category, in particular treating young children aged 0-1 years. The urgency level of patients in the GP group was higher than it was in the NP group. This difference can be explained by the fact that digestive, cardiovascular and neurological complaints often have a higher urgency level.

We found no differences in patient characteristics between GPs in the experimental arm and GPs in the control arm. We found, as expected, that GPs who worked in a team with one NP saw more patients who had been excluded from NP care as a result of the exclusion criteria. This might have an impact on the GP's caseload since these patients are considered to be more complex cases. However, even though the difference was statistically significant, it does not seem clinically relevant since it was a relatively small difference. Considering our exclusion criteria, theoretically, more than three-quarters of the patients in out-of-hours primary care can be diagnosed and treated by an NP independently. This also indicates that substitution in out-of-hours care is only possible in a team of GPs, as a GP needs to be present to treat patients with more complex complaints.

Overall, the most common complaints we saw during out-of-hours care were skin, musculoskeletal, respiratory, digestive and general and unspecified complaints. These complaints, with the exception of digestive complaints, all fall within the scope of NP care. These prevalence rates of ICPC groups and the large number of patients presenting non-urgent complaints are comparable to those found in other out-of-hours services in Western countries.^{7,8,41} This makes the results generalizable to other out-of-hours primary care settings.

Although the results concur with studies conducted in primary care during daytime, this does not mean that they are simply generalizable to daytime care. A study during daytime reported that most complaints treated by NPs were related to conditions of the skin, throat, nose, ears or the respiratory or musculoskeletal systems.⁴ These results are consistent with the results we obtained in terms of ICPC groups. Nevertheless, the complaints (i.e. ICPC codes) were different. For example, skin conditions presented during daytime primary care mainly included acne, eczema, warts and rash, whereas in our study, lacerations, scalds, skin infections, insect bites and bruises occurred more often. This difference can be explained by the fact that the out-of-hours service is for acute complaints, whereas during daytime primary care, patients more often visit an NP because of common, non-acute complaints.

It is important to stress that the NP profession does not solely serve as an extension of GPs' care. Instead, their knowledge and expertise (such as an holistic nursing approach and supporting self-management in patients) offers additional benefits for primary

care.^{18,42,43} How to use NPs to their full potential is still a matter of political and organizational exploration worldwide.¹⁸ This question is, however, beyond the scope of this study. The way out-of-hours primary care is organized in the Netherlands – together with eight other Western countries where the GPC is the dominant organizational model – provides a good example internationally how out-of-hours care could be organized.² In this study, we did not change the out-of-hours care model, but deployed the NP as substitutes of GPs. This is because primary care out-of-hours services still face difficulties with the rising number of patients demanding care when daytime surgeries are closed. Innovations to comply with the increasing demand in out-of-hours care are observed internationally. There are new models such as an emergency care access point (ECAP) for out-of-hours emergency care where triage determines whether patients will be seen by a GP or by a physician in the emergency department. Although this model enhances the efficiency of emergency departments, it increases the number of patients receiving a consultation at the GPC.⁴⁴ Also other models, like emergency nurse practitioner service for patients with minor injuries, are implemented and although promising rarely evaluated.²¹ These developments fuel the need for more evaluation of NPs offering out-of-hours care.

Strengths and limitations

A strength of this study is its relatively large patient sample and the generalizability in terms of ICPC groups. A limitation of the study is that it was conducted at one GPC with a small group of NPs (n = 5). Consequently, the generalizability to a larger population of NPs and other GPCs is not yet clear. The NPs all volunteered to participate in the study to give an extra boost to their profession. Their motivation might have influenced their work attitude and therefore the results. Another limitation may be that although the NPs all had at least 5 years of professional experience, none of them had previously worked at the GPC prior to this study.

Unfortunately, at least 25% of all consultations had to be excluded from part of the analysis due to a missing ICPC code. It appeared to be the same GPs who did not report an ICPC code, which means the bias is on the level of the GP instead of the ICPC diagnosis. This is supported by the fact that the ICPC codes in our study are similar to those of other GPCs.

We followed the normal procedures of the GPC where professionals choose their own patients from the presentation list. Another possibility was triage by nurses who perform the telephone triage at the call centre.³¹ However, not only would this be less efficient, it would also impact the NPs' authority as professionals who can make their own clinical decisions. The pragmatic design was, therefore, an accurate

representation of daily practice. Patients were not informed in advance about whether it was an experimental or control day or whether they were going to receive treatment from an NP or GP. Also GPs did not know in advance whether they would work on an experimental or control day, and so this did not influence their choice to either work or decline a shift at the GPC.

It should also be noted that this study took place in a large GPC with an emergency care access point. The size of the GPC (i.e. number of patients and professionals) might determine how NP services can be implemented. In our setting, four GPs worked on the same shift as one NP and a large number of patients visited the GPC. This means that there were enough patients from whom the NP could choose and a GP was always available for more complex cases. It is not known whether our findings can be generalized to smaller out-of-hours services.

Our findings suggest (taking our exclusion criteria into account) that it should be possible to form a team with more NPs than GPs (ratio: 1 GP:3 NPs). Whether this is actually possible and safe in practice requires further investigation, since acute care like that provided at the GPCs must be able to deal with unpredictable factors (e.g. acute patients cannot be prescheduled, peak hours are hard to predict and specialist care is less accessible).

Finally, this study shows the effect of the NP in this particular Dutch setting. However, the education and deployment of NPs differ between and even within countries and health-care systems.^{6,11,45-48} In countries like the United States, Canada and Australia, the NP role in primary care is well developed. However, in most countries, the NP's role is relatively new or non-existent. The growing interest in NPs stresses the need for clarifying the scope of NP practice and more research from different countries. That would enable cross-country comparison and a collective understanding of global challenges.^{6,27,45} Since patient characteristics in this study are consistent with those shown in out-of-hours primary care in other Western countries, the results can be translated to countries' own specific rules and regulations concerning the NP's scope of practice.

CONCLUSION

Our findings suggest that in out-of-hours primary care, a GP can be substituted by an NP in a team with other GPs just like in daytime primary care. The team with an NP provides care to the same number and type of patients. Consistent with what they learned in their master's training programme, NPs saw a broad range of common complaints. Differences between the patients seen by NPs and GPs were mainly due to complaints that do not fit the predefined scope of NP care. GPs' caseloads in terms of number and patient characteristics did not meaningfully change. In areas where there is a shortage of GPs, for example in rural areas, administrators could consider introducing nurses who are competent to independently treat patients with a broad range of diseases to offer timely care to patients with acute problems. Taking our exclusion criteria into consideration then, in theory, more than 75% of the patients visiting out-of-hours primary care fit the scope of NPs competences. Further research is needed to find out how many GPs in a team offering out-of-hours care can actually be substituted by NPs and what the costs of such alternatives are.

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The impact of substituting
general practitioners with
nurse practitioners on
resource use, production and
health-care costs during out-
of-hours: a quasi experimental
study

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ABSTRACT

Background: The pressure in out-of-hours primary care is high due to an increasing demand for care and rising health-care costs. During the daytime, substituting general practitioners (GPs) with nurse practitioners (NPs) shows positive results to contribute to these challenges. However, there is a lack of knowledge about the impact during out-of-hours. The current study aims to provide an insight into the impact of substitution on resource use, production and direct health-care costs during out-of-hours.

Methods: At a general practitioner cooperative (GPC) in the south-east of the Netherlands, experimental teams with four GPs and one NP were compared with control teams with five GPs. In a secondary analysis, GP care versus NP care was also examined. During a 15-month period all patients visiting the GPC on weekend days were included. The primary outcome was resource use including X-rays, drug prescriptions and referrals to the Emergency Department (ED). We used logistic regression to adjust for potential confounders. Secondary outcomes were production per hour and direct health-care costs using a cost-minimization analysis.

Results: We analysed 6,040 patients in the experimental team (NPs: 987, GPs: 5,053) and 6,052 patients in the control team. There were no significant differences in outcomes between the teams. In the secondary analysis, in the experimental team, NP care was associated with fewer drug prescriptions (NPs 37.1 %, GPs 43 %, $p < .001$) and fewer referrals to the ED (NPs 5.1 %, GPs 11.3 %, $p = .001$) than GP care. The mean production per hour was 3.0 consultations for GPs and 2.4 consultations for NPs ($p < .001$). The cost of a consultation with an NP was €3,34 less than a consultation with a GP ($p = .02$).

Conclusions: These results indicated no overall differences between the teams. Nonetheless, a comparison of type of provider showed that NP care resulted in lower resource use and cost savings than GP care. To find the optimal balance between GPs and NPs in out-of-hours primary care, more research is needed on the impact of increasing the ratio of NPs in a team with GPs on resource use and health-care costs.

BACKGROUND

In many Western countries primary health care is under pressure due to a rising demand on primary care and rising health-care costs.¹⁻³ These developments fuel the need for innovative models for organizing health-care delivery more efficiently. Substituting general practitioners (GPs) with nurse practitioners (NPs) is considered worldwide a promising health-care delivery model.⁴⁻⁶ Substitution of care is feasible since NPs have the ability to treat a large proportion of the complaints presented in primary care autonomously.⁷⁻⁹ The deployment of NPs has the potential to reduce GPs' workload, improve efficiency, increase service capacity and improve quality of care.^{5,10}

Nurses as GPs' substitutes in primary daytime practices can provide good quality and safe care, with patient outcomes at least similar to those of GPs.¹¹⁻¹⁴ Nurse-led care is associated with longer consultation times and lower productivity, an equal number of prescriptions, and equal or more referrals to other services.^{10,11,14} This would imply that nurse-led care does not necessarily save costs, and might potentially increase costs. Therefore, monitoring the impact of substituting GPs with NPs on resource use and health-care costs is an essential part in the evaluation of skill mix changes.¹⁰ However, only a few studies have investigated the effect of NPs in primary care on health-care costs and the results of the available studies are inconclusive.^{4,6,12,14} Outcomes of substitution, resource use and health-care costs in particular are likely to depend on the particular context of care and outcome measures.

Just like in daytime practice, the debate is rising over whether NPs are capable of substituting for GPs in out-of-hours care, where patients present themselves with acute problems. In the Netherlands, GPs provide care for their patients 24/7 and are the gatekeepers to hospital care. As in the UK and Denmark, out-of-hours primary care is most often organized in large-scale general practitioner cooperatives (GPCs). This means GPs take turns in being on duty to take care of all patients within a region outside office hours.^{15,16} Although the deployment of NPs in general practices during daytime is increasing, it is relatively new in the GPCs and there is a lack of evidence about the efficiency of substituting GPs with NPs in those services. Results from daytime are not generalizable to out-of-hours care due to the potentially acute character of the presented symptoms and complaints.^{17,18} As far as we know, there hasn't been a study conducted on the impact of nurses substituting in out-of-hours primary care on resource use and health-care costs.

METHODS

Aim

To evaluate the effect of substituting GPs with NPs in out-of-hours care on resource use, production and health-care costs.

Design

Pragmatic quasi-experimental trial comparing two types of teams providing out-of-hours primary care. In the experimental arm, care is provided by a team of four GPs and one NP, from 10 a.m. – 5 p.m. on a weekend day. In the control arm, care is provided by a team of five GPs on the other weekend day from 10 a.m. – 5 p.m. In addition, care provided by the NPs is compared to that of GPs in the experimental arm.

Study setting

The evaluation was part of a quasi-experimental study, which was conducted at a general practitioner cooperative (GPC) situated within a hospital next to the Emergency Department (ED) in the south-east of the Netherlands. In this GPC, GPs work in shifts from 5 p.m. – 8 a.m. on weekdays and the entire weekend to take care of a population of approximately 304,000 people. All patients in need of acute care during out-of-hours contact the GPC via a single, regional telephone number where triage nurses decide whether patients receive telephonic advice, a consultation at the GPC, a home visit or referral to the ED. Patients who receive a consultation at the GPC are scheduled in a common presentation list. GPs and NPs choose attending patients from this presentation list.¹⁶

Study population

General practitioners and nurse practitioners

A sample of five NPs and 138 GPs participated in this study. GPs' mean age was 49.3 years (SD 9); 60 % were male and on average the GPs had been associated with the GPC for 7.3 years (SD 3.7).

All NPs had at least five years of experience working as a licensed NP in primary care or elderly care. None of the NPs had experience working at the GPC prior to the study. Therefore, they received three half days of additional training in commonly presented complaints during out-of-hours.¹⁶ In the Netherlands, the title 'Nurse Practitioner' is protected by law and exclusively reserved for those who have completed a Master

Advanced Nursing Practice (NLQF/EQF level 7; accredited by the NVAO), and are registered in the specialist register. All NPs have previous experience in nursing at Bachelor of Nursing level. NPs have the authority to independently indicate and perform reserved procedures (including prescribing medicines) in his/her area of expertise using the same guidelines as GPs.^{7,19} This is a major difference from the widely implemented practice in the Netherlands whereby practice nurses take care of patients with chronic complaints following evidence based protocols. These practice nurses are usually operating at a Bachelor of Nursing level (NLQF/EQ Level 6) and are, in contrast to NPs, always working under supervision of a GP and not authorised to diagnose and prescribe medicine autonomously.²⁰

Based on the educational training of the NPs, the GPC in this study excluded the following patients from NP care: those younger than one year and those with psychiatric complaints, abdominal pain, chest pain, a neck ailment, headache or dizziness. Based on the information of the triage nurse, NPs decided which patients from the common presentation list they would call in for consultation. Patients excluded from NP care would receive consultation from a GP. In cases where the complaint of the patient during the triage was different from the complaint during the consultation, NPs were allowed to decide autonomously whether they felt competent or not to complete the consultation themselves, whether they consulted the GP about the patient or whether to refer the patient to the GP.

Patients

All patients who visited the GPC during the data collection were included in the study. Due to the explorative character of the study a statistical power calculation could not be done reliably. In order to get reasonably accurate estimates, a 15-month follow-up was chosen to get a sufficiently large sample.

Randomization

The experimental and control days were rotated systematically between Saturday and Sunday. The five-week rotation scheme was determined in advance. Days were randomized between Saturday and Sunday to avoid bias due to possible differences in patient presentations on those weekend days. Patients were unaware of experimental or control days when they contacted the GPC. The GPs were randomly assigned to the weekend days; they did not know whether they would work with an NP at the time of scheduling.

Measures and data collection

The primary outcome was resource use following a consultation at the GPC. Resource use included X-rays, drug prescriptions and referrals to the ED. Other imaging tests or laboratory samples than X-rays could not be ordered by the providers. If such diagnostic tests were necessary patients were referred to the ED or to their own GP the next day. Data related to resource use were measured as dichotomous outcome variables.

Secondary outcomes were production per hour (indicated as the mean number of patients per care provider per hour) and direct health-care costs. Direct health-care costs were based on personnel costs (based on production per hour and salary) and costs per unit of resources used for each consultation (X-rays, drug prescriptions and referrals to the ED). Here volumes are combined by unit prices that constitute costs.

Data abstracted to compare baseline characteristics included potential confounders for the comparison: age (in four categories), urgency (in five categories), gender, and type of complaint (indicated as an International Classification Primary Care [ICPC] code). All data were abstracted from the electronic medical patient records at the GPC and coded by the care providers as part of their routine during the consultation.

Data were collected from April 2011 to July 2012.

Analysis

Baseline characteristics

Baseline characteristics of the study population are presented as a proportion (%) since all measures (age, gender, urgency level and type of complaint (ICPC)) were measured in categorical variables. Differences between the experimental arm and control arm were tested using a Chi^2 test. The same analysis was performed in secondary analysis comparing baseline characteristics between patients treated by the NP and patients treated by the GP in the experimental arm.

Resource use

Resource use (i.e., X-rays, drug prescriptions and referrals to the ED) was evaluated by analysing differences in volumes between groups. Logistic regression analysis for dichotomous outcomes was conducted to compare the two study arms. To adjust for potential confounders a second logistic regression model was used that corrected for

age, gender, urgency level and ICPC group. The same analysis was performed in the secondary analysis to compare the NPs and GPs in the experimental arm.

Production per hour

Production per hour was calculated by dividing the total number of patients per care provider by the exact number of hours per care provider. This resulted in a mean number of patients treated per hour per care provider. A linear mixed model was used to test the differences in production per hour between the teams. Results were corrected for holidays, weekend days, number of professionals and the total number of patients per day. The same analysis was performed in the secondary analysis to compare the NPs and GPs in the experimental arm.

Direct health-care costs

The economic evaluation was designed as a cost-minimization analysis, considering direct health-care costs of the consultation only. In this analysis, based on previous study reviews, patient outcomes of the two study conditions are assumed to be equal.²¹ Direct costs were calculated for each consultation separately including costs for care provider, X-rays, drug prescriptions and referral to the ED.

Costs for the GP and NP time per consultation were calculated by dividing the tariff per hour by the mean production per hour. For NPs the tariff was based on their salary from the GPC, including social security contributions (approximately 40 %) and premium pay (50 %). For GPs the tariff was based on the payment agreements with health insurance companies. This tariff is calculated on the basis of a total tariff per GPs' patients for providing 24/7 care.

The tariff valid for the GPC per care provider per hour was €77 for GPs, and €65,46 and €66,38 for NPs (see Table 1). Next, following the guidelines of the Dutch Manual for Costing, the cost for each referral to the ED was set at €151 and €43,98 and €45,37 for an X-ray.²² As a result of the differences between the minimum and maximum price for medicine, two separate costs were calculated per drug prescription. All the direct health-care costs were calculated using the tariffs that were valid for the intervention period (see Table 1).

Table 1. Prices per unit in 2011-2012

<i>Resource</i>	<i>Unit</i>	<i>Costs (€)</i>	<i>Data source</i>
Salary costs GP	Hour	€77	GPC (based on agreements with health insurance companies)
Salary costs NP	Hour	€65,46 (as per 1-4-2011) €66,38 (as per 1-4-2012)	GPC
Drug prescription	Consultation	Variable (minimum and maximum prices)	www.medicijnkosten.nl (indicated by Dutch Manual for Costing) ²²
X-ray	Consultation	2011: €43,98 2012: €45,37	The Dutch Healthcare Authority (NZa) (indicated by Dutch Manual for Costing) ²²
Referral to the Emergency Department	Consultation	€151	Dutch Manual for Costing ²²

To provide further insight into the cost differences, a t-test was performed to compare the unadjusted estimates between the experimental and control arm. Second, to adjust for potential confounders a linear regression model was used that corrected for case mix (i.e., age, gender, urgency level, ICPC group). For the cost of drug prescriptions the minimum price per medicine was used in the primary analysis. Deterministic uncertainty was explored by one-way sensitivity on costs of drug prescriptions by including the maximum price per medicine. The same analysis was used in the secondary analysis to compare NPs and GPs in the experimental arm.

Finally, we applied a bootstrapping procedure (with 1,000 replications) to manage the highly skewed costs across patients. The statistical analysis, including the bootstrapping, was carried out using SPSS software version 22 (SPSS Inc, Chicago, IL, USA).

RESULTS

The experimental arm included 34 Saturdays and 29 Sundays (63 intervention days), and the control arm included 29 Saturdays and 34 Sundays (63 control days). In total, 12,092 patients had a consultation during the study period. In the experimental arm, 987 patients visited an NP and 5,053 patients visited one of four GPs. In the control arm, 6,052 patients visited one of five GPs. A total of 3,101 cases (10.0 % with an NP,

27.0 % with a GP) could not be analysed due to a missing ICPC code (a flow diagram of the study is shown in Fig. 1).

Baseline characteristics

There were no significant differences in patient characteristics between the experimental and the control arm (Table 2 shows the 10 most presented complaints). However, as expected given the exclusion criteria, significant differences were found between GPs and NPs for patients’ age ($p=.002$), urgency level ($p<.001$) and type of complaint ($p<.001$).¹⁸ GPs saw more patients aged >64 years, with an urgency level of U2, and suffering digestive, cardiovascular and neurological complaints. NPs saw more patients suffering skin and respiratory complaints and with an urgency level of U4.

Figure 1. Flowchart of the study

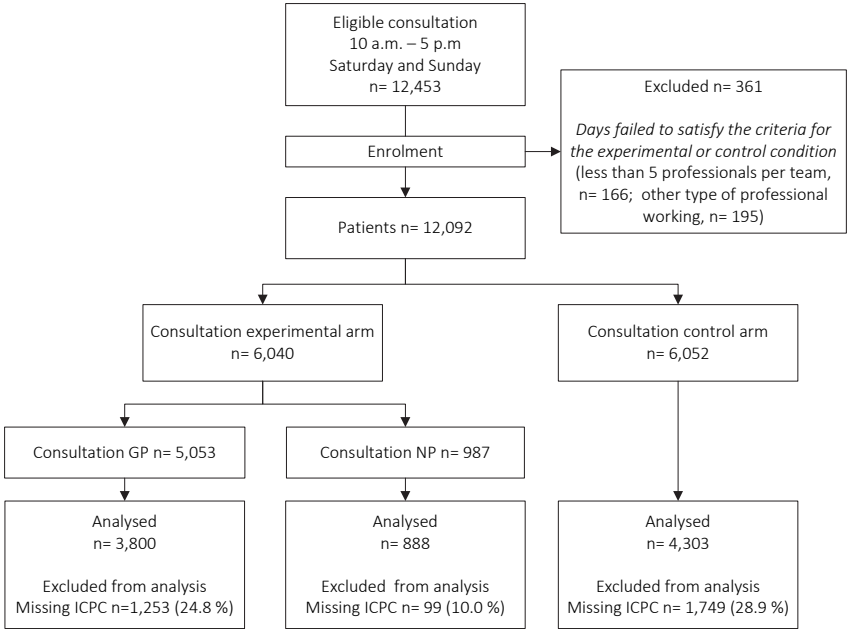


Table 2. Baseline characteristics, top 10 ICPC groups

	<i>Control arm</i>	<i>Experimental arm</i>	<i>GP Experimental arm</i>	<i>NP Experimental arm</i>
<i>Complaints (%)*</i>				
Skin	21.7	22.7	20.7	31.2
Musculoskeletal	20.5	20.1	19.6	22.2
Respiratory	15.2	14.2	13.7	16.3
Digestive	10.5	9.9	11.4	3.0
Eye	6.0	6.1	6.5	4.4
General and unspecified	5.9	6.5	6.6	6.0
Ear	5.7	5.8	5.6	6.8
Urological	5.5	5.7	5.7	5.6
Cardiovascular	2.5	2.5	2.9	0.7
Neurological	2.3	2.3	2.8	0.3
Other	4.2	4.2	4.5	3.5

Tested using a Chi² test

*significant difference between the GP and NP in the experimental arm.

Resource use

Experimental arm vs control arm

Table 3 shows both the unadjusted and adjusted differences in X-rays, drug prescriptions and referrals to the ED. Across the overall sample, the team in the experimental arm compared to the control arm less often ordered an X-ray (4.4 % vs. 5.3 %; $p=.017$), less often prescribed drugs (42.0 % vs. 44.1 %; $p=.022$) and less often referred patients to the ED (10.2 % vs. 11.6 %; $p=.02$). However, none of these differences remained significant after adjusting for case mix (i.e., age, gender, urgency level, ICPC group).

NPs vs GPs in the experimental arm

NP care was associated with fewer drug prescriptions (37.1 % vs. 43 %; $p<.001$) and fewer referrals to the ED (5.1 % vs 11.3 %; $p<.001$) than GP care. These differences remained significant after adjusting for case mix. There was no statistical significant difference between NPs and GPs with regard to ordering X-rays (NPs 5.6 % vs. GPs 4.2 %).

Table 3. Rate differences of resource use following a visit to the GPC

	Experimental vs control arm				Experimental arm GP vs NP			
	95% CI for exp b				95% CI for exp b			
	B (SE)	Lower	Exp b	Upper	B (SE)	Lower	Exp b	Upper
Unadjusted estimates								
X-ray	-.202* (.09)	.692	.817	.965	-.303 (.156)	.544	.738	1.002
Drug prescription	-.084* (.037)	.855	.919	.988	.246*** (.072)	1.111	1.279	1.472
Referral ED	-.136* (.058)	.779	.873	.979	.866*** (.152)	1.766	2.378	3.202
Adjusted estimates								
X-ray	-.203 (.11)	.682	.816	1.006	-.168 (.19)	.588	.846	1.115
Drug prescription	-.09 (.05)	.838	.9161	1.001	.317*** (.077)	1.167	1.373	1.616
Referral ED	-.13 (.07)	.759	.877	1.014	.60** (.179)	1.277	1.814	2.576

Tested within a logistic regression model. Adjusted estimates are adjusted for age, gender, urgency level and ICPC group

* $p < .05$

** $p < .01$

*** $p < .001$

Production per hour

The mean production per professional was 2.9 consultations per hour in both the experimental arm and the control arm. In the experimental arm the mean number of consultations per hour was 3.0 for GPs and 2.3 for NPs ($p < .001$).

Direct health-care costs

Based on the tariff per hour and the production per hour, the mean costs per GP consultation were calculated at €25,67 and the costs per NP consultation were calculated at €27,28 (as per April 2011) and €27,66 (as per April 2012).

Experimental arm vs control arm

Table 4 presents the unadjusted and adjusted cost differences between the experimental and the control arm. The mean costs of a consultation in the experimental arm were €2,05 less than a consultation in the control arm (95 % CI: €-3,79; €-0,29; $p=.02$). However, this difference did not remain significant after correcting for case mix (i.e., age, gender, urgency level, ICPC group). In the sensitivity analysis with the maximum cost per medication the adjusted difference remained non-significant (95 % CI: €-3,65; €0,15).

GPs and NPs in the experimental arm

The mean cost per consultation on the experimental day was €7,58 less for a consultation with an NP than for a consultation with a GP (95 % CI: €-10,82; €-4,34; $p<.001$) (see Table 4). After correction for case mix a significant difference of €-3,34 remained in favour of the NP (95 % CI: €-5,97; €-0,65; $p=.02$). The main influence on the difference in costs was the number of patients referred to the ED. In the sensitivity analysis with the maximum costs per medication the adjusted difference between the experimental and control arm increased to €-3,51 (95 % CI: €-6,77; €-0,24; $p=.04$).

Table 4. Unadjusted and adjusted differences in direct health-care costs following a consultation at the GPC

<i>Experimental vs control arm</i>				
	<i>experimental</i>	<i>control</i>	<i>Mean difference</i>	<i>95% CI</i>
Unadjusted mean cost per consultation (minimal medication costs)	€44,93	€46,98	€-2,04*	€-3,79; €-0,29
Adjusted mean cost per consultation (minimal medication costs)			€-1,53	€-3,36; €0,46
<i>Experimental arm GP vs NP</i>				
	<i>GP</i>	<i>NP</i>	<i>Mean difference</i>	<i>95% CI</i>
Unadjusted mean cost per consultation (minimal medication costs)	€46,17	€38,59	€-7,58**	€-10,82; €-4,34
Adjusted mean cost per consultation (minimal medication costs)			€-3,34*	€-5,97; €-0,65

Tested within a linear regression model. Adjusted estimates are adjusted for age, gender, urgency level and ICPC group.

* $p < .05$

** $p < .001$

DISCUSSION

Statement of principal findings

This study did not find a significant difference between teams with an NP and teams with only GPs with regard to X-rays, drug prescriptions and referrals to the ED. Moreover, the production per hour and the cost per consultation for the team with an NP were not different from teams with only GPs.

In the experimental team, NP care was found to be associated with significantly fewer drug prescriptions and fewer ED referrals than care delivered by GPs. NPs were shown to have a lower production per hour than GPs. The cost per consultation with an NP was lower than with a GP.

Strengths and weaknesses

A strength of the current study is its large patient sample and a long follow-up period, but limitations include the single-centre character of the study and the low number of nurse practitioners involved. Moreover, we had a relatively large number of missing ICPC codes. There appeared to be only a few GPs who repeatedly did not report ICPC codes, which means the bias is related to the GP and not the ICPC diagnosis or day. This is supported by the fact that the ICPC codes in our study are comparable to those of other out-of-hours services in Western countries.¹⁸ Therefore, we don't suspect that the missing ICPC codes will cause any bias to our outcomes.

It should be noted that the current study shows the effect of NPs within a GPC. Although many countries have organized out-of-hours care in large-scale organizations in previous years, the various types of health-care systems influence the generalizability of the research findings.¹⁵ Moreover, the education and deployment of NPs differs between, and even within, countries and health-care systems. In the Netherlands, as in most countries, NPs providing care are always working as part of primary care teams alongside GPs.^{20,23} Our results can therefore not be generalized to other models of care in which NPs are working in teams without GPs.²⁴ Moreover, in the current study the NPs were primarily responsible for treating minor ailments. The complexity of tasks can differ between regions and countries.

In the current study, NPs with no experience working at the GPC at the start of the study were compared with GPs who had on average 7.3 years of experience at the GPC. This may have influenced resource use or production per hour. A strength of the current study is the fact that researchers did not change patient allocation, which gives an accurate representation of the daily practice and related cost estimates.

We only included costs relevant from the GPCs' viewpoint (tariff per hour, production per hour) and direct health-care costs relevant from health insurance companies' viewpoint (X-rays, drug prescriptions and referrals to the ED). This implies that it is not possible to draw conclusions on whether the deployment of NPs is cost saving from a societal viewpoint. Therefore, other factors, such as the difference in costs of training, rates of sick leave, patient follow-up after a GPC visit or after ED referral, et cetera, should have been included.^{22,25}

Comparisons with other studies

Meta-analyses based on research conducted in daytime primary care did not show differences between nurses and GPs in terms of prescriptions, diagnostic test orders and referrals.¹⁰ Although, in line with these meta-analyses, we did not find differences at team level, our secondary analysis in the experimental team showed a difference between GPs and NPs in terms of drug prescriptions and referrals to the ED. We cannot determine whether this difference in resource use is an overuse of medication or referrals by GPs, or an underuse by NPs. There is no capacity to examine how clinical outcomes would differ from the likely outcomes if patient care was provided by the other care provider.²⁶ Inappropriate referrals and prescriptions may further increase health-care costs and unnecessary treatments in the hospital. Based on reviews of research, we do not expect an underuse by NPs since patient outcomes in primary care were found to be at least equivalent for NPs and GPs.^{12,14} Moreover, research on the ED and hospital care shows that the diagnostic accuracy of NPs is comparable to that of doctors.^{27,28}

We found a lower production per hour for NPs than for GPs. However, it was not possible to adjust this outcome for case mix. This makes comparison between GPs and NPs difficult since they treat different patients. However, we expect the number of consultations per hour to be a reliable measure. This is supported by the fact that our outcomes are comparable to results from meta-analyses on consultation times.¹⁰ Besides treating different patients, lower production per hour can also be associated with less experience.¹¹ Although NPs had at least five years of experience in primary or elderly care, none of them had any experience in out-of-hours primary care at the start of the study. Other possible explanations for longer consultations include a higher use of protocols,¹⁰ and a more holistic approach and greater provision of information by NPs than by GPs.²⁹ In addition, the provision of more health education and information by NPs may result in fewer prescriptions.³⁰

Based on previous research, we expected NP care to be cost saving due to a lower salary for NPs than for GPs.³¹ However, in line with another study, lower production per hour appeared to lessen the influence of salary differences on consultation costs.³² Another reason for the small influence of salary costs on overall costs is the small difference in tariff between the GPs and NPs during out-of-hours care. This is because the GPs receive financial compensation for out-of-hours care based on the total tariff for providing care to their patients 24/7. This means that the GPs receive a fixed tariff, whereas the tariff per hour for NPs was based on their gross salary including social security contributions and premium pay. The differences in tariff per hour would have been bigger in cases where the care providers were employed by the GPC in the same way. For example, the difference in gross salary of a GP employed by another GP and the NPs in our study is approximately 60 %.³³ In another Dutch study in daytime primary care, the salary of an NP appeared to be less than half of that of a GP. As a consequence, in that study, cost differences were mainly caused by the difference in salary.³⁴ It is expected that bigger differences in salary will result in more cost savings when GPs are substituted with NPs.

The current study shows that the differences in referral rates to the ED strongly influenced consultation costs. The fewer referrals by NPs resulted therefore in lower mean costs of care provided by NPs than by GPs. It is difficult to compare these findings with previous research due to conflicting results on the effect of substituting GPs with NPs in primary care on the cost of health care. Moreover, due to heterogeneous outcome reporting and the small number of studies they are hard to interpret. However, in general, NP care seems to be associated with lower or equal health-care costs per consultation.^{6,12} Only one study found increased costs associated with NP care. These results were based on two factors that we did not measure: time spent by GPs on supervising and number of return visits.³² The time spent on supervising in the current study was, however, relatively low. The NPs consulted a GP in only 7.1 % of all consultations. Only 0.2 % of the patients were taken over by the GP; the other consultations were completed by the NP. Consultations between the NP and GP are considered part of daily practice and comparable to consultations GPs have with other GPs. Therefore, we do not expect this to bias our outcomes.

Study implications

The current study shows no differences in resource use and direct health-care costs between teams with an NP and teams with GPs only. Therefore we conclude that during out-of-hours, involvement of NPs in multidisciplinary teams can increase capacity without increasing resource utilization.

Our results show that using NPs as substitutes for GPs in out-of-hours care is a feasible solution for decreasing GPs' workload or increasing service capacity. It should be noted that tasks at GPCs are limited to providing acute care and do not use NPs' competences to the full. Tasks such as preventive projects, psycho-social home visits, providing ongoing training for staff and developing protocols are only performed during the daytime. In countries where GPs deliver 24/7 care, the implementation of NPs in primary care will only succeed when they (just like GPs) provide care 24/7.

With the need for extra workforce in primary care, our data suggests that substitution by NPs can be considered an solution economical equal to the care delivered by GPs. However, because we only included one GPC, and only measured direct costs, results should be interpreted with caution. Economic evidence on which to make judgments on future out-of-hours care is far more complicated.³⁵ Other costs from a societal perspective such as training cost and unemployment rates of physicians in hospital care have to be taken into account. This implies that decisions on the substitution of GPs by NPs in out-of-hours primary care should not only depend on costs, but on other factors such as a view on professional roles, responsibilities, and quality and safety of care.³²

As this study showed a significant difference in cost per consultation in favour of NPs, it may be possible that deploying more NPs in a team with GPs is more cost saving. Future research is needed to indicate an optimal balance in which teams with NPs and GPs provide the most efficient care for patients in out-of-hours primary care.

CONCLUSION

The current study indicated no differences between teams with an NP and teams with only GPs with regard to resource use, production per hour and direct health-care costs. However, in teams with an NP, the NP appeared to make fewer drug prescriptions and fewer referrals to the ED than the GPs. Due to lower resource use, the cost of a consultation with an NP was less than that of a consultation with a GP. The current study shows that involvement of NPs in teams with GPs can increase capacity without increasing resource utilization during out-of-hours. More research is needed to find the optimal balance between GPs and NPs to cover all patient care in out-of-hours primary care efficiently. Obviously, decisions on substituting GPs with NPs should be based on the full range of considerations, including a view on the professional roles and responsibilities of NPs in of out-of-hours care, rather than just arguments related to resource use and costs.

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Towards an optimal composition
of general practitioners and
nurse practitioners in out-of-
hours primary care teams: a
quasi-experimental study

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ABSTRACT

Objectives: To gain insights into the ability of general practitioners (GPs) and nurse practitioners (NPs) to meet patient demands in out-of-hours primary care by comparing the outcomes of teams with different ratios of practitioners.

Design: Quasi-experimental study

Setting: A GP cooperative (GPC) in the Netherlands.

Intervention: Team-2 (1 NP, 3 GPs) and Team-3 (2 NPs, 2 GPs) were compared with Team-1 (4 GPs). Each team covered 35 weekend days.

Participants: All 9,503 patients who were scheduled for a consultation at the GPC through a nurse triage system.

Outcome measures: The primary outcome was the total number of consultations per provider for weekend cover between 10 am and 6 pm. Secondary outcomes concerned the numbers of patients outside the NPs' scope of practice, patient safety, resource use, direct health-care costs and GPs' performance.

Results: The mean number of consultations per shift was lower in teams with NPs (Team-1: 93.9, Team-3: 87.1; $P<0.001$). The mean proportion of patients outside NPs' scope of practice per hour was 9.0% (SD 6.7), and the highest value in any hour was 40%. The proportion of patients who did not receive treatment within the targeted time period was higher in teams with NPs (Team-2, 5.2%; Team-3, 8.3%) compared to GPs only (Team-1 3.5%) ($P<0.01$). Team-3 referred more patients to the emergency department (14.7%) compared to Team-1 (12.0%; $P=0.028$). In teams with NPs, GPs more often treated urgent patients (Team-1: 13.2%, Team-2: 16.3%, Team-3: 21.4%; $P<0.01$) and patients with digestive complaints (Team-1: 11.1%, Team-2: 11.8%, Team-3: 16.7%; $P<0.01$).

Conclusions: Primary health-care teams with a ratio of up to two GPs and two NPs provided sufficient capacity to provide care to all patients during weekend cover. Areas of concern are the number of consultations, delay in patient care and referrals to the emergency department.

INTRODUCTION

The quality of out-of-hours primary care influences the functioning of the whole health-care system. Internationally, different organizational models are used to deliver urgent care during out-of-hours practice. Patients in the United Kingdom have access to services such as walk-in centres, urgent care centres, out-of-hours centres, telephone consultations and emergency departments (EDs), which often operate side by side.¹ However, these services show varying results in terms of patient outcomes and efficiency.²⁻⁴ In the Netherlands, out-of-hours care is organized in general practitioner cooperatives (GPCs).⁵ Although these large GP-based models show positive results,³ current and expected problems, such as population aging, the increased prevalence of chronic conditions and the shifting of tasks from hospitals to the community, put pressure on (out-of-hours) primary care.^{6,7} The challenge for policymakers is to find a model that ensures accessibility, quality and efficiency in out-of-hours care.^{1,8}

As many complaints during out-of-hours care do not necessarily require the knowledge and skills of a GP, there is increasing interest in care delivery models that include nurse practitioners (NPs) in primary care teams.⁹⁻¹¹ Systematic reviews of published research have shown that NPs in daytime primary care provide good-quality and safe care to patients, but not necessarily more efficient care compared to GPs.¹²⁻¹⁴ There are models in which care is provided by teams with only NPs, but such services are not able to provide high-quality care to some patients due to a lack of capacity, resources or skill levels. In light of the above, team-based care involving both GPs and NPs is an alternative model for delivering out-of-hours care.

Current evidence does not provide insights into the optimal ratio of GPs and NPs in out-of-hours teams. The results for NPs in daytime primary care cannot simply be translated to out-of-hours care. Organizations differ in size, the incidence of life-threatening conditions is higher in out-of-hours settings and care outside office hours is unpredictable in terms of patient flow. The acute nature of complaints limits the potential for forward scheduling and the main complaint after triage does not always correspond to the main complaint evaluated during consultation.^{15,16} Second, while overall patient care is determined by the sum of its parts, most studies compare care between health-care providers rather than comparing teams.¹⁷ To the best of our knowledge, this is the first randomized comparative study to provide insights into the optimal composition of GPs and NPs in primary care teams during out-of-hours provision.

Aim

The aim of the study was compare teams with different ratios of GPs and NPs in terms of the number of consultations, patient care and GPs' performance and provide insights into the number of patients outside the NPs' scope of practice in out-of-hours primary care.

METHODS

Design

A quasi-experimental study was conducted to measure the total number of patients and the distribution of patients outside NPs' scope of practice in out-of-hours primary care over the weekend (Saturday and Sunday) between the hours of 10 am and 6 pm. Two types of teams with NPs were compared with a team comprising only GPs, as follows:

Team-1: care provided by a team of four GPs (care as usual)

Team-2: care provided by a team of three GPs and one NP

Team-3: care provided by a team of two GPs and two NPs

Study setting

The study was conducted at a GPC situated within a hospital next to the ED in the south-east of the Netherlands. In this GPC, GPs work in shifts from 5 pm to 8 am on weekdays and over the entire weekend, taking care of a population of approximately 304,000 people. All patients in need of acute care outside regular office hours contact the GPC using a single, regional telephone number. Triage nurses then allocate patients to an appropriate care pathway based on risk stratification. Patients who are eligible for a consultation at the GPC are scheduled on a common presentation list, depending on the urgency of the complaints based on the Netherlands Triage Standard (NTS; see Table 1). A maximum of five patients are scheduled every hour per health-care provider. GPs and NPs select attending patients from this presentation list.¹⁸

Table 1. Netherlands Triage Standard (NTS) urgency levels¹⁹

<i>Urgency level</i>	<i>Description</i>	<i>Time period for consultation</i>
U1	Life threatening: Immediate action required, the vital functions are threatened or delaying treatment will cause serious and irreparable damage to the patient's health.	Within 15 minutes
U2	Emergent: Vital functions are not (yet) in danger, but there is a fair chance that the patient's condition will soon deteriorate or delaying treatment will cause serious and irreparable damage to the patient's health. Take action as soon as possible.	Within 1 hour
U3	Urgent: Do not postpone too long. Treat within a few hours because of medical- or humane reasons.	Within 3 hours
U4	Non-urgent: There is no pressure resulting from medical- or other grounds. Time and place of treatment should be discussed with the patient.	No time pressure
U5	Advice: A physical examination can wait until the next day.	No time pressure

Study population

General practitioners

All GPs who delivered patient care during the study period were included. This included both practice owners (n=162) and GPs employed by another GP. Their mean age was 47.5 years (SD 9.7) and 50.3% were male. Those employed by another GP have often recently graduated.

Nurse practitioners

A sample of 10 NPs participated in the study. Their mean age was 45.2 years (SD 9.4) and one was male. On average, they had been qualified as an NP for 1.8 years (SD 1.2) and had worked at the GPC for 1.6 years (SD 1.1). All NPs had completed a two-year Master's programme on 'Advanced Nursing Practice' (NLQF/EQF level 7). This programme included an academic course on treating common complaints in primary care and an internship in general practice.^{20,21} During office hours, they took care of patients with minor ailments in general practices and undertook elderly care or care

for disabled people. To ensure their competency to work in out-of-hours care, they received three half days of additional training concerning complaints commonly presented during out-of-hours care: eye disorders; musculoskeletal disorders, such as fractures, bruises and sprains; wound care (e.g. suturing). NPs in the Netherlands have the authority independently to indicate and perform reserved procedures (including prescribing) in their area of expertise, using the same practice guidelines as GPs.^{22,23} The numbers of support staff at the GPC (1 receptionist and 1 medical assistant per shift) were equal for the different teams.

Patients

All patients who had a consultation at the GPC during the period of data collection were included in the study. Due to the exploratory nature of the study, no calculation of statistical power could reliably be made. To attain reasonably accurate estimates, a 35-week follow-up period per team was selected to obtain a sufficiently large sample. NPs decided which patients from the common presentation list would be called in for consultation; other patients received a consultation with a GP. In the case that the patient's complaint during triage was different from that during the consultation, NPs were allowed to decide autonomously whether they felt competent or not to complete the consultation themselves. If not, they could consult a GP about the patient or refer the patient to a GP at the GPC.

Allocation to study arms

The teams were rotated systematically between Saturday and Sunday. The rotation scheme was determined in advance. GPs were randomly assigned to the days over the weekends and they did not know whether they would work with an NP at the time of scheduling.

The scheduling of the patients was done by triage nurses at a call centre, which is in charge of scheduling patients for several GPCs. They were blind to the composition of GPs and NPs in the team, only knowing the total number of team members. As a consequence, patients were not informed of the presence of NPs in the teams when they contacted the call centre.

Measures and data collection

The primary outcome was the number of consultations per team and per health-care provider. This was measured as the mean number of patients per team per day and per health-care provider per hour.

In terms of secondary outcomes, we first focused on the number of patients outside NPs' scope of practice. In the Netherlands, NPs are allowed to enter independently into a treatment relationship in their area of expertise and take independent decisions about the interventions to be executed.²³ In addition to this national authority, the GPC has formulated a scope of practice for NPs based on their professional training. All the patients meeting the following criteria were defined by the GPC as being outside NPs' scope of practice: patients younger than one year old, or suffering psychiatric complaints, abdominal pain, chest pain, a neck ailment, headache, or dizziness (see Table 2). All other patients were within NPs' scope of practice.¹⁸ We looked at all patients presenting at the GPC on Saturdays and Sundays between 10 am and 6 pm and measured the percentage and distribution of those patients who were outside NPs' scope of practice.

Next, we measured the effect of different team compositions comprising NPs and GPs on: 1) patient care and 2) aspects of GPs' performance. Patient care included four measures, based on which the different teams were compared: patient safety, resource use following a consultation at the GPC and direct health-care costs. Patient safety was examined using two measures, the first of which included the number of (near) incidents. In the Netherlands, GPCs are required by law to report (near) incidents to an internal committee for the reporting of patient care incidents. Both patients and providers are able to report (near) incidents. Second, the number of patients who did not receive care within the targeted time period was calculated. At the call centre, triage nurses classify all patients into urgency levels. The NTS defines the time period in which a patient needs treatment (see Table 1). Resource use included X-rays, drug prescriptions and referrals to the ED. Imaging tests or laboratory samples other than X-rays could not be ordered by the providers. If such diagnostic tests were necessary, patients were referred to the ED or to their own GP the next day. Next, direct health-care costs were calculated based on personnel costs (based on the number of consultations per hour and salary) and combining volumes of resource use by unit prices that constitute costs.

The impact on aspects of GPs' performance was measured by comparing GPs' patient characteristics and resource use. The characteristics of GPs' patients included age, urgency level and the International Classification of Primary Care (ICPC) code. In addition to these characteristics, the number of patients outside NPs' scope of

practice treated by GPs in different teams was compared. Finally, the percentage of consultations in which NPs asked for consultation with a GP was measured.

All data were extracted from the electronic medical patient records at the GPC and coded by the providers as part of their routines during the consultations. Data were collected from May 2014 to November 2015.

Table 2. Patients outside the predefined scope of NP care

<i>Patient characteristics and complaints expressed during triage defined by the GPC as being outside NPs' scope of practice</i>	<i>Patient characteristics and diagnoses defined as outside NPs' scope of practice during data analysis</i>
Patients younger than one year old	Age < 1 year
Patients suffering from psychiatric complaints	ICPC group P Psychological
Patients suffering abdominal pain	ICPC group D Digestive (except ICPC codes: D04 (Rectal/anal pain), D05 (Perianal itching), D19 (Teeth/gum symptom/complaint), D20 (Mouth/tongue/lip symptom/complaint))
Patients suffering chest pain	ICPC group K Cardiovascular (except ICPC codes: K06 (Prominent veins), K07 (Swollen ankles/oedema), K95 (Varicose veins of leg), K96 (Haemorrhoids))
Patients suffering neck ailment	ICPC code L01 Neck symptom/complain
Patients suffering headache or dizziness.	ICPC group N Neurological (except ICPC code: N72 (Tetanus))

Statistical analysis

Baseline characteristics

Baseline characteristics were presented as proportions (%) and included potential confounders for the comparison: age (in four categories), urgency (in five categories), gender and type of complaint (indicated as an ICPC code). Differences between Team-1 and Teams-2 and Team-3 were tested using a Chi² test.

Primary outcome

First, the total number of patients per team was calculated. An independent sample t-test was used to test differences in the number of consultations per shift between Team-2 and Team-3 and Team-1. The mean number of consultations per professional per hour was calculated by dividing the total number of patients per team by the exact number of hours and the number of health-care providers per team. In addition, we calculated the number of consultations per hour for the GPs and NPs separately.

Secondary outcomes

Percentage and distribution of patients outside NPs' scope of practice

First, we took the ICPC codes from all patients presenting themselves at the GPC over weekends and identified those patients whose diagnosis fitted the complaints excluded from NP care (see Table 2). Descriptive analysis (mean; SD) was used to indicate the percentage of patients outside NPs' scope of practice .

To gain an insight into the distribution of patients over a day, the total number of patients outside NPs' scope of practice per hour was divided by the number of patients who could be scheduled per hour (maximum of 5 patients per health-care provider per hour = 20 patients per team per hour).

Comparison of patient care between teams

Patient safety was evaluated through descriptive analysis, used to determine the number of (near) incidents. Differences between teams in terms of the number of patients receiving treatment within the targeted time period were tested using logistic regression analysis for dichotomous outcomes. Estimates were adjusted for ICPC group, age and the proportion of patients with a U2 urgency level per day.

Resource use (i.e. X-rays, drug prescriptions and referrals to the ED) was evaluated by analysing differences in volumes between teams. Logistic regression analysis for dichotomous outcomes, corrected for age, gender, urgency level and ICPC group was conducted to compare Team-2 and 3 with Team-1.

Direct health-care costs were examined through an economic evaluation designed as a cost-minimization analysis, considering only the direct health-care costs of the consultation.²⁴ Direct costs were calculated for each consultation separately including costs for personnel, X-rays, drug prescriptions and referral to the ED.

Costs for personnel per consultation were calculated by dividing the tariff per hour by the mean number of patients per hour. The tariff per hour for NPs was set at €61.32 based on their salary from the GPC, including social security contributions (approximate 40%) and premium pay (50%). The tariff for GPs was set at €74.66 based on the payment agreements with health insurance companies. GPs in the Netherlands receive a tariff per patient for providing 24/7 care. Based on these tariffs, the total tariffs per hour per team were €298.64 for Team-1, €285.30 for Team-2 and €271.96 for Team-3. To provide a better comparison between GPs' and NPs' tariffs, we also calculated a tariff based on the salary for GPs employed by another GP (specified in collective labour agreements). This tariff included social security contributions and premium pay, similar to NPs, and was set at €93.56 per hour. The inclusion of this tariff resulted in total tariffs per hour per team of €374.24 for Team-1, €342.00 for Team-2 and €309.76 for Team-3.

Next, following the guidelines of the Dutch manual for costing, the cost of each referral to the ED was set at €261 and for an X-ray at €52.79.²⁵ As a result of the differences between the minimum and maximum prices for medicine, two separate costs were calculated per drug prescription. All costs were valid for the year 2015.

To provide insights into the cost differences between Team-2 and -3 and Team-1, a linear regression model was used, corrected for case mix (i.e. age, gender, urgency level, ICPC group). In the primary analysis, the minimum price per medicine and the personnel costs valid for the GPC were used. Deterministic uncertainty was explored through: (i) one-way sensitivity analysis for the costs of drug prescriptions, including the maximum prize per medicine; (ii) one-way sensitivity analysis of personnel costs, including the tariff for GPs employed by another GP. Finally, we applied a bootstrapping procedure (with 1000 replications) to manage the highly skewed costs across patients.

Comparison of aspects of GPs' performance between teams

To obtain the *patient characteristics* for those seen by GPs in the different teams, descriptive statistics were used for patients' age, gender, urgency level and type of complaint (ICPC). Differences between GPs in Teams-2 and -3 and Team-1 were tested using the Chi² test for categorical data. Descriptive analysis was used for the number of patients outside NPs' scope of practice treated by GPs in different teams.

Resource use (i.e. X-rays, drug prescriptions and referrals to the ED) was evaluated by analysing differences in volumes between GPs in different teams. Logistic regression analysis for dichotomous outcomes, corrected for age, gender, urgency level and ICPC

group, was conducted to compare resource use by GPs in Teams-2 and -3 and that of GPs in Team-1.

Consultations between NPs and GPs were examined using the codes reported by NPs in patients' medical records when they consulted a GP concerning a patient. There were three codes in the case that NPs consulted a GP but completed the patient consultation themselves: (i) consultation with a GP by telephone; (ii) consultation with a GP outside the surgery room; (iii) consultation with a GP in the surgery room. A fourth code was reported when the patient was referred to a GP to complete the patient consultation. Descriptive analysis was used to indicate the percentage of patients for whom NPs requested consultation with a GP.

The outcomes of two-tailed tests were considered statistically significant at an alpha level $P < 0.05$. The statistical analyses, including bootstrapping, were carried out using SPSS software version 22 (SPSS Inc, Chicago, IL, USA).

Deviation from the original study protocol

The study protocol (ClinicalTrials.gov ID NCT02407847) described an extra study arm comprising a team with one GP and three NPs. Ethical approval for this study was obtained based on the arms in the study being part of GPCs' normal routines (CMO-no. 2014-1409). This meant that the teams followed on from each other in consecutive phases and each phase was followed by an evaluation. The final decision to continue with the last phase, incorporating the team with more NPs, was in the hands of the GPC management. Because the GPC decided not to continue, data on the team with one GP and three NPs as described in the protocol could not be compared to data from the other teams and are therefore not part of this paper.

RESULTS

All patients presenting during the study period were included in the analyses (see figure 1). There were no significant differences in terms of age, gender or ICPC group between the teams (see Table 3). In all teams, the top four of ICPC codes covered more than two-thirds of all patients and included skin (21%), musculoskeletal (21%), respiratory (14%) and digestive (11%) complaints. In comparison to Team-1, Team-2 treated slightly more patients with an urgency level of U2 (14.3% vs. 13.2%) and fewer patients with an urgency level of U3 (47.5% vs. 51.8%) ($P = 0.01$).

Figure 1. Flow diagram of the study

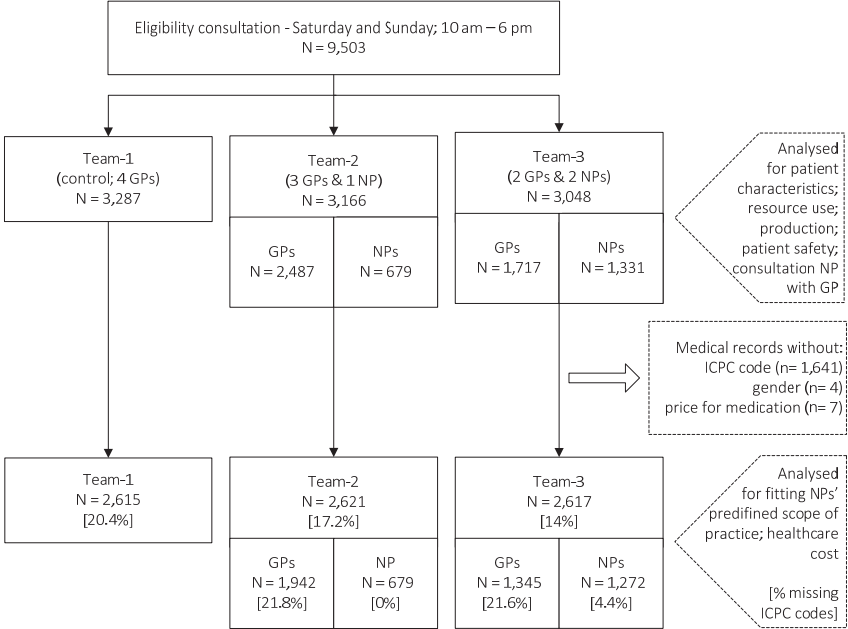


Table 3. Baseline patient characteristics

	<i>Team-1 (control; 4 GPs)</i>	<i>Team-2 (3 GPs & 1 NP)</i>	<i>Team-3 (2 GPs & 2 NPs)</i>	<i>GPs Team-1</i>	<i>GPs Team-2</i>	<i>GPs Team-3</i>
Age in categories (%)						***
0-1 year	4.1	3.5	4.6	4.1	3.9	7
2-17 years	22.6	24.3	25.8	22.6	22.4	22.4
18-64 years	57.5	56.2	54.3	57.5	56.7	54.2
65 years and older	15.8	16	15.3	15.8	16.9	16.5
Gender (% male)	46.7	46.9	47.9	46.7	46.2	46.6
Urgency (%)		*			**	***
U1	0.1	0.1	0.1	0.1	0.1	0.1
U2	13.2	14.3	15.3	13.2	16.3	21.4
U3	51.8	47.5	50.5	51.8	46.9	47.8
U4	31.0	33.8	30.6	31	32.4	27.4
U5	3.9	4.3	3.4	3.9	4.3	3.3
Complaints top 10 (%)					**	***
Skin	22.0	21.8	19.3	22	18.7	13.6
Musculoskeletal	20.6	21.7	22.0	20.6	19	18.5
Respiratory	14.3	13.0	15.8	14.3	12.6	16
Digestive	11.1	9.6	11.0	11.1	11.8	16.7
General and unspecified	7.3	7.4	7.4	7.3	8.1	7.9
Eye	5.9	6.0	6.1	5.9	6.4	5.3
Urological	5.6	7.1	5.2	5.6	7.9	5.6
Ear	4.7	4.3	4.7	4.7	4.2	3.7
Neurological	2.9	2.8	2.6	2.9	3.6	3.9
Cardiovascular	1.9	1.9	1.8	1.9	2.5	2.7
Other	3.8	4.3	4.1	3.8	5.1	5.9

Tested using a Chi²-test

* Significant difference with Team-1 $P < 0.05$

** Significant difference with GPs in Team-1 $P < 0.01$

*** Significant difference with GPs in Team-1 $P < 0.001$

Primary outcome: Total number of consultations

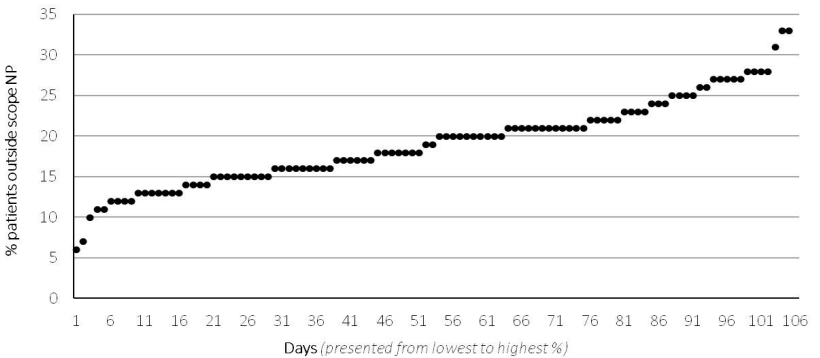
In total, 9,503 patients had a consultation during the study period. Team-1 had contact with 3,287 patients, Team-2 with 3,166 patients and Team-3 with 3,048 patients. The mean number of consultations per shift by the teams was 93.9 (SD 9.0) in Team-1, versus 90.5 (SD 7.2) in Team-2 (not significant) and 87.1 (SD 6.2) in Team-3 ($P<0.001$). The mean number of consultations per hour per health-care provider was 3.1 consultations in Team-1, 3.0 consultations in Team-2 (GP 3.2, NP 2.6) and 2.9 consultations in Team-3 (GP 3.3, NP 2.5).

Secondary outcomes

Percentage and distribution of patients outside NPs' scope of practice

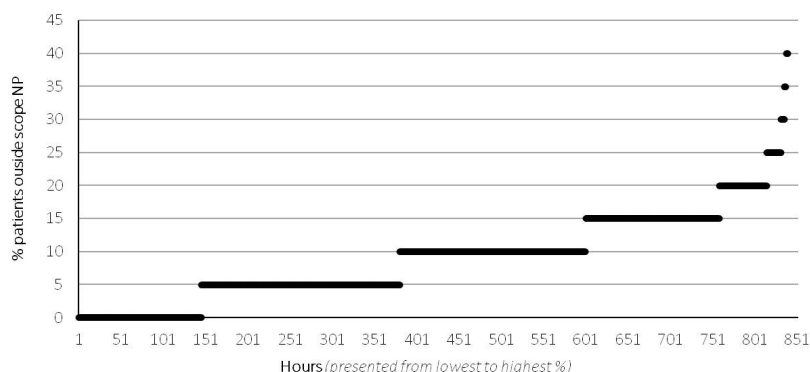
Overall, the number of patients outside NPs' scope of practice, expressed as proportion of the total number of patients per day, was 19.1% (SD 50.4). The range of patients per day outside NPs' scope of practice was 6% to 33% (see Figure 2). There was no difference between Saturdays (18%) and Sundays (20%), or between Team-1 (19.9%), Team-2 (18.0%) and Team-3 (19.4%).

Figure 2. Patients outside NPs' scope of practice per day over weekends (expressed as the proportion of the total number of patients per day)



The absolute number of patients outside NPs' scope of practice was a minimum of 0 and a maximum of 8 per hour. Expressed as proportion of the total number of patients who could be scheduled (= 20 per hour), the maximum proportion of patients outside NPs' scope of practice per hour was 40% (mean 9.0%, SD 6.7) (see Figure 3).

Figure 3. Patients outside NPs' scope of practice per hour over weekends (expressed as the proportion of the total number consultations that can be scheduled per hour)



Comparison of patient care between teams

No (near) incidents were reported during the study. The proportion of patients who did not receive a consultation within the targeted time period according to the NTS was 3.5% in Team-1, 5.2% in Team-2 and 8.3% in Team-3. After adjusting for confounders, the proportion of patients who did not receive a consultation within the targeted time period was significantly higher in Team-2 ($P=0.001$) and Team-3 ($P<0.001$) compared to Team-1 (see Table 4).

Across the overall sample adjusted volumes of resource use did not change significantly for X-rays between Team-1, Team-2 and Team-3. Compared to Team-1, after correction for casemix, Team-2 more often prescribed drugs (respectively: 41.3% vs. 44.2%, $P=0.033$). In contrast, Team-3 did not prescribe more drugs (39.5%; not significant). The number of patients referred to the ED was 12% in Team-1, 13.2% in Team-2 and 14.7% in Team-3. After adjusting for casemix the difference between Team-3 and Team-1 was significant ($P=0.028$) (see Table 4).

Table 4. Comparison of teams in terms of resource use and patient safety

	<i>Team-2 (3 GPs & 1 NP) vs Team-1 (control; 4 GPs)</i>				<i>Team-3 (2 GPs & 2 NPs) vs Team-1 (control; 4 GPs)</i>			
	<i>95% CI for exp b</i>				<i>95% CI for exp b</i>			
	<i>B (SE)</i>	<i>Lower</i>	<i>Exp b</i>	<i>Upper</i>	<i>B (SE)</i>	<i>Lower</i>	<i>Exp b</i>	<i>Upper</i>
X-ray ¹	-0.09 (0.16)	0.67	0.91	1.24	-0.17 (0.16)	0.62	0.84	1.15
Drug prescription ¹	0.13 (0.06)*	1.01	1.14	1.28	-0.07 (0.06)	0.83	0.93	1.05
Referral ED ¹	0.10 (0.09)	0.92	1.11	1.33	0.20 (0.09)*	1.02	1.22	1.45
Consultation not within targeted time period ²	0.30 (0.14)**	1.02	1.35	1.77	0.67 (0.13)***	1.51	1.95	2.52

¹ Tested within a logistic regression model adjusted for age, gender, urgency level and ICPC group

² Tested within a logistic regression model adjusted for age, ICPC group and proportion of patients with urgency level U2 per day

* $P < 0.05$

** $P < 0.01$

*** $P < 0.001$

The costs for personnel per consultation were €23.85 in Team-1, €23.65 in Team-2 and €23.41 in Team-3. The inclusion of costs of other resources (X-rays, medication, referrals to the ED) led to total mean costs per consultation in the primary analysis of €59.22 (SD 86.63) in Team-1, €62.23 (SD 90.49) in Team-2 and €65.68 (SD 94.11) in Team-3. After adjusting for age, gender, urgency and ICPC group, the costs per consultation in Team-3 were significantly higher compared to those in Team-1 ($P=0.04$). In the sensitivity analysis, which used the tariff of a GP employed by another GP, the costs for personnel per consultation were €29.89 for Team-1, €28.36 for Team-2 and €26.66 for Team-3. There were no significant differences between teams in the sensitivity analyses using the tariff for a GP employed by another GP or in the sensitivity analyses using the maximum price for medications (see Table 5).

Table 5. Comparison of teams regarding direct health-care costs

	<i>Team-1 (control; 4 GPs) vs Team-2 (3 GPs & 1 NP)</i>		<i>Team-1 (control; 4 GPs) vs Team-3 (2 GPs & 2 NPs)</i>	
	<i>Corrected mean difference</i>	<i>95% CI</i>	<i>Corrected mean difference</i>	<i>95% CI</i>
Primary analysis (personnel cost GPC, X-ray, minimum price drug prescriptions, referral ED)	€-3,01	€-7,33 to €1,48	€-4,55*	€-8,94 to €-0,09
Sensitivity analysis 1 (personnel cost GPC, X-ray, maximum price drug prescriptions, referral ED)	€-3,07	€-7,65 to €1,09	€-4,45	€-8,83 to €0,05
Sensitivity analysis 2 (personnel cost tariff GP employed by another GP, X-ray, minimum price drug prescriptions, referral ED)	€-1,68	€-6,00 to €2,81	€-1,76	€-6,15 to €2,70

Tested within a linear regression model with bootstrapping (1000 replications) adjusted for age, gender, urgency, ICPC group

* $P < 0,05$

Comparison of aspects of GPs' performance between teams

Compared to GPs in Team-1, GPs in Team-3 treated patients with different age categories ($P < 0.001$), especially more patients < 1 year old (see Table 3). Moreover, there were significant differences in urgency level between GPs in Team-2 ($P = 0.001$) and Team-3 ($P < 0.001$) compared to Team-1; specifically, GPs treated more patients at urgency level U2 and fewer patients at U3. Finally, there were significant differences in the types of complaints for patients treated by GPs in Team-1 compared to GPs in Team-2 ($P < 0.01$) and Team-3 ($P < 0.001$). Major differences included more digestive complaints and fewer skin problems. Moreover, GPs treated a greater proportion of patients outside NPs' scope of practice with increasing numbers of NPs in the team. In Team-1 19.9% (SD 5.1) of GPs' patients were outside the scope of NP practice, in Team-2 22.5% (SD 6.4) and in Team-3 30.8% (SD 9.1). Based on the number of consultations per shift, the absolute number of patients outside NPs' scope of practice treated per GP per shift was on average 4.7 patients in Team-1, 5.3 in Team-2 and 7.6 in Team-3.

Across the overall sample, adjusted volumes of resource use did not change significantly for X-rays between GPs in Team-1, Team-2 or Team-3. Compared to GPs in Team-1, GPs in Team-2 more often prescribed drugs (respectively: 41.3% vs. 45.4%, $P = 0.002$). There was no difference between GPs in Team-1 and those in Team-3

(40.8%). In addition, GPs in Team-3 more often referred patients to the ED (18.5%) compared to GPs in Team-1 (12.0%) (P=0.003) (see Table 6).

Finally, in Team-2, NPs completed 93.4% of their consultations autonomously, without consulting a GP. In Team-3, they completed 97.5% of the consultations without recourse to a GP. Across the overall sample, consultations among NPs and GPs were within the surgery room in 1.9% of cases, outside the surgery room in 1.3% of cases and on the telephone in 0.6% of cases. There were no cases reported in which the patient was referred to the GP in order for the GP to complete the patient consultation.

Table 6. Comparison between GPs in terms of resource use

	<i>GPs Team-2 (3 GPs & 1 NP) vs GPs Team-1 (control; 4 GPs)</i>				<i>GPs Team-3 (2 GPs & 2 NPs) vs GPs Team-1 (control; 4 GPs)</i>			
	<i>B (SE)</i>	<i>95% CI for exp b</i>			<i>B (SE)</i>	<i>95% CI for exp b</i>		
		<i>Lower</i>	<i>Exp b</i>	<i>Upper</i>		<i>Lower</i>	<i>Exp b</i>	<i>Upper</i>
X-ray	-0.26 (0.18)	0.54	0.77	1.11	-0.12 (0.07)	0.77	0.89	1.02
Drug prescription	0.21 (0.07)*	1.08	1.23	1.40	0.02 (0.03)	0.97	1.02	1.07
Referral ED	0.14 (0.10)	0.95	1.16	1.40	0.10 (0.03)*	1.03	1.11	1.18

Tested within a logistic regression model adjusted for age, gender, urgency level and ICPC group

* P<0,01

DISCUSSION

Statement of principal findings

As a consequence of NPs treating fewer patients per hour than GPs, the total number of consultations per team per shift decreased by approximately 3.7% when the NP-GP ratio increased by one NP (Team-1: 93.9, Team-2: 90.5, Team-3: 87.1). Of the total number of patients who can be scheduled per hour, the mean observed proportion of patients outside NPs’ scope of practice was 9.0% and the highest value in any hour was 40%. This increase lead to higher health-care costs, although this was not sustained in the sensitivity analysis.

Teams with more NPs were associated with an increased number of patients who did not receive care within the targeted time period. Although there were no adverse events reported in any of the teams, this might have a negative impact on patient safety. Moreover, there were more ED referrals by the teams with more NPs. This increase lead to higher health-care cost, although this did not sustain in the sensitivity analysis.

As a consequence of increasing the number of NPs per team, GPs treated a larger proportion of patients outside NPs' scope of practice. These included patients those younger than one year old, patients with urgent complaints and patients with digestive problems. After adjusting for the case mix, GPs working in teams with more NPs referred more patients to the ED. In the overall sample, NPs asked advice from a GP in 3.8% of cases. This means each GP was asked for advice once in every two shifts.

Strengths and weaknesses of the study

As far as we are aware, this is the first study to provide a rigorous comparison between teams providing out-of-hours care and to examine the impact on patients and GPs. The strengths of the study include the comparative evaluation design and large patient sample. The study duration of a year and a half ensured all seasons (with presumably different patient complaints) were included. The limitations of the study are that it was conducted in a single centre only and limitations in the data available, in particularly the relatively large number of missing ICPC codes. The missing ICPC codes were caused by a few GPs who repeatedly did not report ICPC codes (more than 50% of the missing codes were caused by 7% of the GPs), indicating that bias is at the level of the GP and not diagnosis.

A potential limitation includes the method of identifying patients outside NPs' scope of practice based on the diagnosis after consultation. The initial exclusion was based on the complaint presented during triage, which can differ from the actual complaint presented during consultation.^{15,16} However, because there were no reports of consultations initiated by an NP but completed by a GP, it appeared to be uncommon for patients who seemed to be within NPs' scope of practice after triage to turn out not to be during the consultation.

Finally, the economic evaluation was limited to a focus on costs considered relevant from the GPCs' viewpoint, so we cannot draw conclusions on efficiency from a societal viewpoint.

Comparison with other studies

Although evidence is limited, in line with this study, previous studies have suggested that NPs are able to provide 67–93% of all primary care services.²⁶ However, this is the first comparative study to show how teams comprising NPs and GPs may respond to peak loads among patients who do not fit the scope of NPs' practice. As the ICPC codes used in this study are comparable to those of other out-of-hours services in

Western countries, the results are readily generalizable to other models of out-of-hours primary care delivery.²⁷ The generalizability of findings has to be considered with respect to NPs' education, legislation and scope of practice between and within countries and health-care systems.^{28,29}

Reviews of previous studies indicate that patient safety is not negatively influenced by the inclusion of NPs in teams based on the quality of care provided by NPs.¹² As far as we know, this is the first study to measure patient safety in terms of the number of patients who were not treated within a targeted time period based on urgency level. However, this measure only indicates one aspect of increased patient risk and therefore has its limitations. To draw firm conclusions on patient safety, we need more insight into patients' health outcomes after a longer follow-up period. Moreover, it may be queried whether patients who were indicated as being urgent by the call centre were actually urgent cases when they presented themselves at the GPC. A recent study in the Netherlands showed that more than half of the patients who were indicated as being urgent (U2) by the triage nurse were found by the GP at the GPC to be non-urgent (U3 or lower).³⁰ However, there should be no reason why patients in teams with more NPs would not get treatment in time as only a maximum of 40% of the patients who can be scheduled per hour are outside NPs' scope of practice. Delay in care for patients who are outside NPs' scope of practice seems more likely when teams do not collaborate effectively, for example when GPs do not focus on the patients who cannot be treated by NPs.³¹ NPs should treat the full range of patients that fit their scope of practice. However, working in mixed teams is an innovation and GPs express different views concerning team collaboration.^{32,33} Critical factors for successful implementation of the NP role, such as the involvement of all GPs in the implementation process, acceptance of the NP role and understanding of the intentions of role implementations, are especially difficult in large-scale organizations like GPCs.^{31,32}

In line with reviews of previous studies, the introduction of NPs does not necessarily result in greater efficiency.^{12,14} Fewer consultations among NPs can be the result of greater use of protocols, better provision of information or less experience compared to GPs and might have further influenced delays in patient treatment.³⁴⁻³⁶ As the evidence shows that the diagnostic accuracy and use of resources of NPs are comparable to those of physicians, we did not expect an increase in ED referrals when the NP-GP ratio increased.^{34,37,38} We cannot determine whether this increase relates to overuse by one team or underuse by the other because there is no capacity to examine how outcomes would differ if care were provided by another team. Moreover, it remains difficult to draw firm conclusions on health-care costs due to

mixed results from the primary and sensitivity analyses.^{13,39} Consistent with previous studies, care delivered by teams with NPs does not necessarily seem to be associated with lower health-care costs compared to that delivered by the GP-only team in this study.

In accordance with the literature, this study shows a slight increase in the complexity of GPs' caseload.^{33,40} More qualitative insight is needed into how this is experienced by GPs. It might be considered an advantage for GPs to practice more to the full scope of their training.⁴¹ Supervision of NPs barely had an effect on GPs' workloads and the need for supervision decreased even further during the study as NPs gained more experience.

Implications for policymakers and future research

Following the UK's National Health Service (NHS) report 'General Practice Forward View',^{9,42} this study provides an evidence base for expanding the primary health-care workforce through the deployment of nurses. In 99% of hours over the weekend, the proportion of patients outside NPs' scope of practice was less than 25% of all those who could be scheduled. This indicates that teams with both NPs and GPs are well suited to providing all care during out-of-hours practice. The assumption is clearly that NPs provide good-quality care to those patients who are within their scope of practice. Reviews of previous studies show that the quality of care delivered by NPs is comparable to that of GP.^{14,42}

Our results show that incorporating NPs with GPs in out-of-hours primary care teams is a feasible option for reducing GPs' workloads in terms of the number of shifts and increasing service capacity. However, it is still uncertain whether this is a cost-effective solution. Therefore, the optimal ratio of GPs and NPs should not be defined by the impact on efficiency of care itself, but by a long-term vision regarding (expected) demands for care, workforce needs and professional roles. More research is needed on the impact of NPs in out-of-hours care on patient safety in a larger sample of GPCs, developing a more in-depth understanding of team collaboration during out-of-hours provision.

CONCLUSION

A model in which out-of-hours primary care is provided by teams with a ratio of up to two GPs and two NPs offers sufficient capacity to provide care for all patients during out-of-hours practice. Teams with two GPs and two NPs were associated with a decrease in the number of patients per shift and a small increase in referrals to the ED by the team. Patient safety needs extra attention, as the number of patients who did not receive care within the targeted time period in both teams increased. There was a minimal difference in aspects of GPs' performance.

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Collaboration in teams with nurse practitioners and general practitioners during out-of-hours and implications for patient care; a qualitative study

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ABSTRACT

Background: Increasingly, nurse practitioners (NPs) are deployed in teams along with general practitioners (GPs) to help meet the demand for out-of-hours care. The purpose of this study was to explore factors influencing collaboration between GPs and NPs in teams working out-of-hours.

Methods: A descriptive qualitative study was done using a total of 27 semi-structured interviews and two focus group discussions. Data was collected between June, 2014 and October, 2015 at an out-of-hours primary care organisation in the Netherlands. Overall, 38 health professionals (GPs, NPs, and support staff) participated in the study. The interviews were audio-taped and transcribed verbatim. Two researchers conducted an inductive content analysis, involving the identification of relevant items in a first phase and clustering into themes in a second phase.

Results: The following four themes emerged from the data: clarity of NP role and regulation, shared caseload and use of skills, communication concerning professional roles, trust and support in NP practice. Main factors influencing collaboration between GPs and NPs included a lack of knowledge regarding the NPs' scope of practice and regulations governing NP role; differences in teams in sharing caseload and using each other's skills effectively; varying support of GPs for the NP role; and limited communication between GPs and NPs regarding professional roles during the shift. Lack of collaboration was perceived to result in an increased risk of delay for patients who needed treatment from a GP, especially in teams with more NPs. Collaboration was not perceived to improve over time as teams varied across shifts.

Conclusion: In out-of-hours primary care teams constantly change and team members are often unfamiliar with each other or other's competences. In this environment, knowledge and communication about team members' roles is continuously at stake. Especially in teams with more NPs, team members need to use each other's skills to deliver care to all patients on time.

BACKGROUND

The increasing demand for out-of-hours primary health care and the shortage of general practitioners (GPs) in this setting requires the development of innovative models of care delivery to meet the needs of all patients.¹⁻³ As in most western countries, out-of-hours care in the Netherlands is delivered by large scale general practitioner cooperatives (GPC) in which GPs from a region have duties to take care of the population when regular hours care is not available.³ Internationally, as well as in the Netherlands, a growing number of out-of-hours care delivery models provide care to patients in teams with both GPs and nurse practitioners (NPs).^{4,5} Globally, advancing nursing roles in health-care delivery and promoting task-shifting has been supported by policy makers, and regulatory and educational reforms.⁶ Task-shifting between NPs and GPs is being increasingly implemented to help meet the demand for primary care and reduce the work burden of GPs. Such care models enable GPs to effectively utilise their training and experience by focusing on caring for the most vulnerable and complex patients.^{7,8}

Nurse practitioners are capable of providing 67-93% of all primary care to patients, including those who seek care during out-of-hours, given their training and clinical expertise.⁹ Although extant studies show positive outcomes for care delivered by NPs,^{10,11} there are some concerns regarding the deployment of NPs in primary care. Currently, most studies of the involvement of NPs in primary care have focused on care delivered during regular office hours, with limited attention to NP care out-of-hours. To date, we do not have evidence about NP deployment in out-of-hours primary care and its impact for team collaboration.

Team-based care delivery models are key aspects of health care reforms aimed at improving access to care and patient outcomes. Collaboration in such teams involves care providers caring for groups of patients independently and interdependently, supporting each other to fully use their separate and shared skills.¹² Facilitating collaboration between NPs and GPs can have significant consequences for patient care. Schadewaldt, McInnes, Hiller and Gardner¹³ identified 20 barriers and facilitators to collaboration between NPs and GPs in primary care in a systematic review of 27 papers. Examples of barriers and facilitators include clarity of the NP role, complementary practice ideology, time to collaborate and financial support. Although these factors give a broad understanding of collaboration between NPs and GPs, it is questionable whether all factors also apply to collaboration in out-of-hours care as in such settings GPs and NPs rotate in every shift. During regular office hours, in 81% of the Dutch general practices, GPs work alone or with one other GP.¹⁴ In contrast, there are 50 to 250 GPs affiliated with each GPC sharing shifts to deliver out-of-hours care.

Fulltime GPs are, on average, on call twice a month to work six to eight hour shifts each time to deliver care during the evening, night or weekend.^{15,16} Therefore, team members at the GPC differ in every shift and are often unfamiliar with each other and with each other's competencies. Furthermore, they are unlikely to know the patients seeking out-of-hours care and do not have access to patients' medical records prior and during the encounter. Research shows that collaborative practice takes time, and unfamiliarity with each other's skills and competencies constrains team collaboration.^{13,17,18} In addition, in stable teams, NPs and GPs develop favourable collegial relationships over time. Thus, lack of opportunities to work together and unfamiliarity between the team members may negatively affect collaboration, further limiting the effective deployment of NPs in out-of-hours care. It is known that ineffective communication and collaboration in teams negatively influences patient outcomes.^{19,20} This study will contribute to the evidence base for guiding optimal team structures with NPs and GPs in out-of-hours primary care.

METHODS

Aim

The aim of the study was to identify the factors influencing collaboration between GPs and NPs in out-of-hours teams.

Design

This study was part of a large research project that had two components. The first component included a quasi-experimental study that compared different teams providing out-of-hours care (ClinicalTrials.gov ID NCT02407847) [21]. The second component, which included a qualitative study is presented in this paper. This descriptive qualitative study was focused on team members' views regarding factors influencing collaborative practice between GPs and NPs in out of hours. The consolidated criteria for reporting qualitative research (COREQ-32) were used to design and report the study.

Setting and participants

The study was conducted at a GPC in the South East Netherlands. The GPC and the hospital emergency department (ED) share an emergency care access point for self-referred patients, but they operate independently.²² The GPC, with its 160 GPs from the region, serves an area with a population of approximately 304,000 inhabitants.

The GPC has been operating since 2001, and more than half the GPs have been affiliated with the GPC from the start or within the first year of the GPCs' operation. At the start of the study, the mean age of the participants was 47.5 years (SD 9.7) and 50.3% of them were male.

Since 2011, this GPC has employed NPs to deliver out-of-hours care. The 10 NPs employed during the study period had an average of 1.8 years (SD 1.2) experience as an NP and had worked at the GPC for an average of 1.6 years (SD 1.1). At the start of the study, NPs' mean age was 45.2 years (SD 9.4) and only one male NP. In the Netherlands, NPs have the authority to independently initiate and perform reserved medical procedures (e.g. puncture, prescribing medicines and simple surgical procedures) in his/her area of expertise using the same guidelines as GPs.^{23,24} In addition to this national authority, before implementing the NP role, the GPC formulated a scope of practice for the NPs based on NPs' education and training. The following patients were defined by the GPC as being outside an NPs' scope of practice: patients younger than one year or patients suffering psychiatric complaints, abdominal pain, chest pain, a neck ailment, headache, or dizziness. All other patients were within an NP's scope of practice. The GPC distributed the list of patients who were excluded from NP care on the intranet. In addition to the online communication NPs were asked to inform GPs about the excluded patient groups at the start of every shift. Care providers were not offered other training regarding collaboration and team effectiveness during or after the implementation of the NP.

All patients who seek acute care out-of-hours can contact the GPC call centre by a single, regional telephone number. At the call centre triage nurses allocate patients for several GPC locations to an appropriate care pathway based on the risk stratification. All patients who will attend for a consultation at the GPC are scheduled on a presentation list. The triage nurses at the call centre are not part of the team that provides care at the GPC. Moreover, they are not aware of the team structure regarding the ratio of GPs and NPs during our study. After the triage, the patients scheduled for consultation can visit the GPC location in their region. Based on the scheduled time, patients' urgency levels and complaints GPs and NPs call the waiting patients in for consultation.²⁵ The team as a whole is responsible for providing care to all scheduled patients on the presentation list.

Data were collected from two teams with different structures. Team-A comprised three GPs and one NP. Team-B comprised two GPs and two NPs. Both teams were supported by one receptionist and one medical assistant. In the Netherlands, medical assistants have followed four years of education and in primary care they perform

routine diagnostic and therapeutic interventions and are the patients' first point of contact for health education and the booking of practice visits.²⁶

The same individual team members (GPs, NPs, medical assistants, and receptionists) could work in Team-A in one shift and in Team-B on the next shift. Eligible participants included all team members who worked a shift either in team-A or team-B. Participants were invited by the primary researcher or the manager of the GPC by e-mail or telephone to participate, and they were informed of the details of the study.

Data collection

Data were collected between June, 2014 and October, 2015. First, we conducted semi-structured individual interviews. The interview days were planned in advance, and the researchers were unaware which individuals would be part of the team that day. Prior to the interview, participants were asked for written and/or oral informed consent.

Face-to-face interviews were conducted with GPs, NPs, medical assistants and receptionists directly after the shift at the GPC, or by telephone at the first availability of the participants. Teams were interviewed at least during four weekend days with different team members. Data analyses took place concurrently with the interviews to explore emergent themes and determine data saturation. After the first interviews, if necessary more interviews were conducted until researchers agreed data saturation was reached.

Second, in addition to the interviews, focus group discussions were conducted to explore questions arising from the interviews to further enrich the data. Focus group discussions were held with NPs only. GPs conduct only a few shifts per year at the GPC, wherefore they do not have much experience in working with NPs at the GPC. Data saturation about their experiences with NP collaboration was reached during the individual interviews. NPs work at least one shift a week at the GPC, and individual interviews did not produce sufficient information to get in-depth insight into collaboration during the shifts. During the focus group interviews, NPs were encouraged to talk with each other and share their experiences and perspectives on team collaboration. The focus group discussions were held in February, 2015 and May, 2015 at the office of the Foundation for Development of Quality Care in General Practice.

The individual interviews and focus group discussions were conducted by MB and RB, both female health scientists. The participants did not know the researchers prior to the study. Field notes were taken during the data collection. The interviews and focus

groups were audio-taped and then transcribed verbatim. Data were anonymized and kept confidential.

Interview guide

The interview guide was developed by the primary researcher (MB) with guidance from the co-authors (ML, RB). Three main topic areas were included in the guide: experiences of working in collaborative practice, barriers and facilitators regarding collaborative practice, and the implications of collaborative practice for patient care. Each topic area included two or three open-ended questions to encourage participants to discuss their perspectives and considerations about their experience, workload, professional routines, communication, work agreements, and patient care. The discussion guide for the focus groups included the same topics. Because the NPs who participated in the individual interviews also participated in the focus groups, results from the individual interviews were used as a starting point for the focus group discussion. Participants were encouraged to reflect on the findings and discuss NP and GP collaboration during shifts and how it impacts patient care.

Data analysis

First, transcribed interviews and focus group data were coded inductively. Coding was done with constant discussion of interpretations by two researchers (MB, IM), guided by the research aim, resulting in one joint codebook. The codes for both teams were then grouped into overall themes at a higher level of theoretical abstraction. Data were declared to have reached saturation when, in both teams, no new codes were emerging. Atlas.ti software V.7.1.5. was used to analyse the data. Interpretation of the results and assessment of data saturation started during data-collection by the two researchers and the project leader (MB, ML, RB). An independent workgroup of NPs, GPs and medical assistants provided feedback on the preliminary findings, which was used to sharpen the analysis. The final elicitation of themes and categorization of interview material into themes was performed by three researchers (MB, ML, LP).

RESULTS

All invited participants agreed to participate in the interviews. A total of 27 interviews were conducted, 12 in team-A and 15 in team-B. In addition, 11 NPs participated in the two focus group discussion. Due to the small number of NPs at the GPC, four NPs participated both in the individual interviews and in the focus group discussions (see

Table 1). The interviews took, on average, 21 minutes; the focus groups, on average, 60 minutes.

Table 1. Participating team members

	Team-A	Team-B	Focus group	Total
N Receptionists	2	2		4
N Medical assistants	2	3		5
N Nurse Practitioners	2	2	11	15*
N General Practitioners	6	8		14
Total	12	15	11	38

* Due to the small number of NPs, four NPs are included in both the individual interviews as in the focus groups

Four themes influencing collaboration in out-of-hours care delivery emerged from the analysis. (see Table 2).

Table 2. Empirically-derived themes influencing collaboration in out-of-hours primary care

Theme 1. Clarity of NP role and regulation
Theme 2. Shared caseload and use of skills
Theme 3. Communication concerning professional roles
Theme 4. Trust and support in NP practice

Theme 1. Clarity of NP role and regulation of NP practice

Regardless of the team structure, there was a general lack of awareness among GPs about NPs’ scope of practice. The GPC formulated the role of the NP in writing, and provided a list on the intranet of those patients who are excluded from NP care. However, in contrast to the NPs, none of the GPs knew about the document or its exact content. Most GPs believed that NPs are not allowed to see complex patients, but they lacked specific knowledge or had misconceptions about the specifics regarding which patients NPs were unable to see. This is illustrated by a GP from team-A: “I know they don’t treat complex patients, or no abdominal pain... I think I know it.” An NP in the focus group stressed the importance of communicating clearly with GPs

regarding the NP scope of practice: “It’s important to be very specific to GPs about what patients we don’t treat. Often they say ‘Oh yeah, I know,’ but turns out they don’t know it at all.”

NPs and medical assistants reported that NPs sometimes treated patients from the excluded patient groups, such as patients younger than one year, when they had the knowledge and expertise to work with these patients. A medical assistant from team-B explained: “The exact scope of the NP is sometimes handled a bit flexibly. NPs might call in patients with, for example, abdominal pain in case it looks like a bladder infection.” Some GPs found it confusing that different NPs treat different patients.

Although legal regulations regarding NP care were not clear for many GPs (e.g. some had the belief they needed to authorise NPs’ drug prescriptions), none of the GPs expressed concerns about legal liability for the NP care. A GP from team-B said: “My knowledge about the role of the NPs is somewhat diluted. Also, some NPs treat different patients than others. I believe I have to authorise NPs’ drug prescriptions as well.” Lastly, most GPs said they did not have prior experience working with NPs in their practice and were uncertain whether they had ever worked with NPs at the GPC before.

Theme 2. Shared caseload and use of skills

In team-A, none of the GPs reported differences in the number of patients and type of patients they treated between teams working in teams with and without NPs. Moreover, although some patients were excluded for NP care, none of the GPs changed his or her professional routine based on the NPs’ scope of practice or in the type of patients he or she cared for. One GP from team-A said: “I started my day with caring for the first patient on the presentation list. I didn’t pay attention to the NP really.”

In team-B, GPs generally stated they had to treat more complex patients compared to working in teams with only GPs. However, there were differences between GPs. One GP from team-B said: “I think the consultations become more intense and difficult; the complaints are more complex.” Another GP from team-B commented; “I think there is not really a difference in the type of patients I treated today, I saw everything.”

In Team-B most GPs said they changed their professional routines by providing care for more complex patients (especially those with abdominal complaints), in order for the NPs to focus on less complex patients. A GP from team-B explained:

“If there are two NPs we have to check all patients on the presentation list, not only their urgency level, but also their complaint. If it’s, for example, an ear infection, I take the next patient and leave the ear infection to the NP. Checking who the patients are on the presentation list is less important in shifts with three GPs.”

Both NPs, medical assistants and receptionists indicated differences between GPs regarding changing their routines in teams with NPs. An NP from team-B commented: “At times I see GPs treating patients that could have been treated by us, while other patients from the presentation list are waiting. Not every GP is willing to cooperate.” General practitioners who had prior experience working with NPs in their practice during office hours were, in general, more willing and aware of the need to focus on more complex patients. If GPs did not change their routines of selecting patients from the presentation list in team-B, patients had to wait longer periods of time to receive treatment from a GP if their complaint did not fit the predefined NP scope of practice. This was a safety risk, especially for the more urgent patients. This is illustrated by examples provided by several team members:

“Some shifts run perfectly, others you think ‘I wish there was a third GP now.’ Especially when there are GPs who pick out patients with skin complaints from the presentation list. You get delay if more patients with abdominal pain show up.”
(Medical assistant, team-B).

“One GP basically picked out all patients. In those cases I have to warn ‘think about the urgent patients’. There was an incident when an older woman got called in for a consultation, while a more urgent man was waiting to see the doctor.”
(Receptionist, team-B)

However, support staff indicated that the condition of the patient in the waiting room is more important than the urgency level determined during earlier triage. Therefore, medical assistants sometimes performed an extra triage in the waiting room to indicate those patients who are in urgent need of care.

Nurse practitioners in team-B did not report they treated different numbers or types of patients compared to working in team-A. An NP in team-B said: “I don’t experience any difference, you continue to treat the same complaints and that costs you the same amount of time.” In addition, NPs in team-B said they did not change their professional routines compared to working in team-A.

In both teams, team members indicated that, in general, NPs spend a longer time on consultations than GPs. Nurse practitioners and GPs assumed this is because NPs take a more extensive patient history and document more in the patients’ medical records. A GP from team-B said: “I must say, a patient with, for example, a sore, I finish those

consultations within a minute and I feel confident to do that. I think NPs are more careful and still take a full history just to be sure they do their work properly.” An NP in the focus group explained; “I think we are more anxious about making mistakes, due to the vulnerable position of NPs in a relatively new profession. I think we take more extensive histories and physical exams. That might also be influenced by less experience.” Moreover, NPs reported they provide more education and counselling to patients.

Both NPs and medical assistants indicated that NPs ask less often for support from the medical assistant compared to GPs; for example, regarding putting on bandages after suturing: “GPs are used to having medical assistants in their practices that take over a lot of tasks. They ask more easily “do you want to take a look at this?” From my experience, NPs more often complete things themselves.” (Medical assistant, team-B).

Lastly, sharing the same practice ideology was not mentioned by any of the participants. They said during the shift they focus on the patients in their own surgery room and lack insight into the other professionals’ patients and treatments.

Theme 3. Communication concerning professional roles

Although GPs and NPs worked in close proximity (consultation rooms are next to each other), both GPs and NPs said, regardless of team structure, there was little communication between them during the shift. A GP in team-A said: “I haven’t spoken to the NP all day, I started directly doing consultations with patients.” Occasionally, they had face-to-face consultation about patients, but GPs and NPs did not feel they delivered care to the patients as a team. An NP in the focus group said: “No, I can’t say it really feels like a team. We work too individualistic. I think you should speak to each other when things are going wrong.” Nurse Practitioners said they communicate with the GP regarding which patient types are excluded from NP care at the start of the shift. Most GPs, especially those whose shift started later in the day, said there were no specific work arrangements communicated about who treats which patients.

“If you all start at 8h, you introduce yourself to the other team members. That didn’t happen today because all doors were already closed and you’re not gonna knock. In that case I just start my work, it’s more practical.”

(General practitioner, team-A).

“At the start of the shift I say “I don’t treat those patients.” That’s it, then you start doing consultations. Making agreements with the GP who starts later isn’t really working, you’re either busy yourself, or the door of the GP is already closed.”

(Nurse practitioner, focus group).

Theme 4. Trust and support in NP practice

The role of the NP was well accepted by receptionists and medical assistants in both teams and they had a positive view about the quality of care delivered by NPs. They also had the impression that patients are satisfied with NP care. As a medical assistant in team-B said: “From my personal experience, I don’t care if I have to work with 2 NPs, or one, or with only GPs.” There were, however, differences among GPs in support for the role of the NP. A receptionist in team-B said: “It’s hard to generalise; the one GP is fine with NPs, the other one sees problems immediately. It’s just another point of view.” Most GPs believed NPs are well capable of treating the patients within their scope of practice. Some even considered the NP being more skilled for certain types of patients than GPs. One GP from team-A explained: “I must say, it’s nice to work with NPs, they have a lot of knowledge in their field of practice. I even asked some advice from the NP today about a stoma, that was helpful.” However, some GPs believed care provided by NPs is of less quality compared to the care delivered by GPs, and certain GPs resisted the role of NPs. One GP in team-B said: “I totally disagree that they try to transform nurses into some sort of GP.” Often, these GPs expressed misconceptions about NPs’ education and legislation governing NP scope of practice. None of the GPs worried about becoming deskilled in treating certain complaints. Even though GPs treated more complex patients when there were more NPs part of the team, in both teams, GPs said that most complaints they treated were still of low complexity.

DISCUSSION

Statement of principal findings

In this study we explored collaboration in teams of NPs and GPs in out-of-hours care. Several important themes emerged in the study and include lack of clarity regarding the NP role and regulations; differences in support for the NP role; variety in team members in sharing caseloads and use of skills; and limited communication during the day. These themes have important implications for collaboration in teams as well as for patient care and outcomes. For example, if team members, both including NPs and

GPs, did not change their professional routines in terms of selecting patients according to their scope of practice, then it may lead to delays in patient care. We also found that in this unique care setting, collaboration between NPs and GPs did not develop over time as these providers do not have opportunities to work with each other. The environment in the GPC did not create a conducive environment for collaboration. Both NPs and GPs seem to deliver care individually with limited opportunities to communicate and share patient information with each other. Moreover, we found that GPs experienced a somewhat more complex workload if there were more NPs in the team; however, this was not a consistent pattern across all participants.

Comparison with other studies

Consistent with findings from other studies, there was a lack of understanding of the NP role which was a major challenge for effective collaboration. Nurse Practitioners' scope of practice excluded care of certain type of patients, which should receive care from GPs; however, GPs were not clear which types of patient should receive care from NPs. A lack of insight into the NPs' role resulted in stagnation in effectively sharing of patient caseload between NPs and GPs, and was shown to increase the risk of delay in care for those patients outside the NPs' scope of practice.^{13,27,28} Therefore, role clarification of the NP is extremely important; however, it might not be adequate to focus only on the NP role.²⁹ In order to promote effective collaboration, it is important to assure that the roles and scope of practice of each members on the team are clear and well-understood, especially in out of office hours care models when team structures that constantly change.

When considering how to effectively deploy NPs, it is important to rethink the role of all team members.³⁰ First, to assure optimal patient flow for all patients, GPs should provide care to patients whose care is outside NPs' scope of practice. Although the effect of NPs' deployment on the workload of GPs remains unclear in the literature, most GPs in the current study indicated that a larger number of NPs in the team led to an increase in complexity of the GPs' workload during the shift.³¹ However, NPs taking on more shifts at the GPC reduced GPs' workload in terms of reducing the number of shifts each GP worked.

Next, some participants reported that NPs took longer time for consultations which sometimes led to delays in patient care. There were two explanations for longer consultation times: one that NPs take longer time to educate patients and take detailed histories, and second, that NPs do not ask for support in a manner that GPs do.³²⁻³⁴ It is important to explore NP consultation to better understand how to help

NPs to be more effective in the use of consultation time. One approach could be to encourage NPs to ask for support so their time can be freed to care for complex needs of patients. Decreasing consultation times by taking less extensive histories or examinations might be inadvisable because premature closing and overconfidence are cited as major biases associated with diagnostic and treatment errors in studies among physicians.³⁵ Moreover, more extended health counselling is likely to improve patient outcomes.³⁶

Lastly, especially in teams with a smaller number of GPs and an increased risk of patient delay, medical assistants play a significant role in the protection of patient safety issues. Their knowledge and expertise are important to indicate urgent patients and assign them to the proper care provider in a timely manner.

Another finding emerging from the study was that the effect of collaboration on patient outcomes depended on the ratio of GPs to NPs in the team. This was caused by the predefined scope of practice of the NPs, whereby some patients could only be treated by GPs. In teams with one NP and three GPs, team members indicated there were enough GPs to care for patients without any delay to those patients who are outside NPs' scope of practice. It was anticipated that this teams with this structure could care for all patients in a timely matter since previous research showed that only 23% of all patients attending out-of-hours are outside NPs' scope of practice.⁴ Although, based on these numbers, teams with two GPs and two NPs also provide enough capacity, there was an increasing risk of patient delay in teams with this structure if team members did not carefully select patients from the presentation list according to their scope of practice. Thus, team members should identify patients' needs collectively, and the two GPs need to focus on those patients who can only be treated by a GP. However, team members indicated that overall providers cared for patients during the shift individually, rather than as a team.

In large scale organisations such as GPCs, creating involvement and acceptance of all team members is difficult.³⁷ The size of the organisation influences the time period to establish a collaborative relationship. Due to the ever changing team members in shifts at GPCs, team members are not well-acquainted with each other; consequently, collaboration hardly developed over time.¹⁸ Therefore, when integrating NPs into teams, managers of the GPCs have to be aware of the need to continuously provide education, resources and support to all team members.¹⁷ Another approach for GPC is to make separate presentation lists for GPs and NPs. Triage nurses at the call centre should be educated to guide patients to the right provider based on the patients' complaints. If doing so GPCs less depend on GPs' willingness to take care of patients

outside NPs' scope of practice. This has however important implications for the education and guidance of triage nurses.

There are also factors outside GPCs' direct reach that are important to establish sustainable collaborative practice in out-of-hours care over time. First, the deployment of NPs in out-of-hours care should go hand-in-hand with their deployment during office hours. Familiarity during office hours will increase understanding and acceptance of the NP role and willingness to collaborate also during the shifts out-of-hours.³⁸ GPs who work with NPs in regular office hours may have favourable perceptions about NPs, which lead to a better collaboration in out of office hours. Although evidence is limited, inter-professional education might be a promising tool to equip future health-care providers for effective collaboration in complex health-care teams. This might help health delivery models such as the GPC to establish stable collaborative practice even though team members differ in shifts and are not familiar with each other.^{39,40}

Limitations

The study has several limitations. The study relied on responses of participants and some participants might not feel comfortable sharing their views with the interviewer. Also, some NPs might not share their views in focus groups. Focus group data of GPs is not available, although it might have given additional information to enhance the findings of the individual interviews. Another limitation of the study includes the single-centre character of the study. Even though GPCs exist in most western countries, there are other organisational models delivering of out-of-hours care.^{3,4} The size of the organisation and the number of shifts of the professionals may particularly influence team collaboration. Also, NPs' scope of practice is likely to affect team collaboration. Teams in organisations and countries where NPs have a different scope of practice might have different experiences and outcomes in collaboration.⁴¹ Internationally lack of consensus exists on job description, skills and educational background for NPs in primary care during and out of office hours has implications for the generalisability of the current findings.^{5,6}

CONCLUSIONS

In this study we explored collaboration between NPs and GPs in out of office hours care. We found that several factors determined collaboration and included differences between GPs in support for the NP role; variety in sharing caseloads and the use of skills; and limited communication regarding collaboration during shifts. Lack of collaboration was more likely to result in patient delay in teams with more NPs. Due to a large number of GPs who work shifts at GPCs, the implementation of collaborative hardly developed over time. Enhancement of collaboration by communicating roles and making work agreements should therefore be continuously on the agenda.

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CHAPTER

8

General

discussion

GENERAL DISCUSSION

This thesis set out to explore the impact of nurse practitioners (NPs) in primary care, the implementation and potential limits of their deployment. The involvement of NPs in primary care is considered a possible strategy to meet increasing demands and save costs. NPs are master's-educated nurses who operate both in the medical and nursing field. They can take over certain tasks previously performed by and restricted to general practitioners (GPs) (substitution of care) or add new and extended services to primary care delivery (e.g. screening of the elderly or vulnerable patient groups) (supplementation of care). Substitution intends to reduce the health-care costs and/or addresses workforce shortages of one type of professional (in this case GPs), whereas supplementation often aims at improving the quality of health care. Despite the body of evidence on the effect of NPs on patient outcomes and on factors influencing the implementation of NPs, there are problems regarding the interpretation of these findings. First, the roles of NPs, outcome measures and health-care systems differ widely in published research. The majority of studies have been conducted in the United States, Canada and United Kingdom, which makes it difficult to generalize findings to the Netherlands. Second, most studies measured outcomes during regular office hours and it is not certain whether these outcomes can be translated to care during out-of-hours. This thesis aimed to contribute to the body of knowledge on the deployment of NPs in primary care, focussing largely on substitution of care in primary out-of-hours care. It provides insight into the impact on patient outcomes, processes of care and resource use and it explores the implementation of NPs in the Netherlands.

This final chapter begins with an overview of the main findings of the thesis. Next, the methodological considerations are discussed. Finally, the interpretation of the findings and the implications of the findings for practice, policy, education and future research are put forward.

MAIN FINDINGS

Findings in the current thesis are based on three different studies. In the systematic review, different types of qualified registered nurses were included, who worked as a substitute for a doctor working in primary care (chapter 2). In our empirical studies (chapters 3 to 7) only NPs who had completed a Master Advanced Nursing Practice (NLQF/EQF level 7) were included.

Impact of nurses working as general practitioners' substitutes

We conducted a systematic review to gain insight into the impact of nurses working as GPs' substitutes on patient outcomes, processes of care outcomes and utilization outcomes (chapter 2). Our systematic review included 18 randomized controlled trials and showed that nurses provided probably equal or possibly better quality of care and achieved equal or better health outcomes for patients compared with primary care doctors. Nurses tended to provide more health advice, had higher adherence to evidence-based guidelines, and were likely to achieve higher levels of patient satisfaction in comparison with primary care doctors. Consultation length was likely to increase with nurse-led care, as well as the frequency of return visits. The frequency of prescriptions, tests, investigations and patients' use of other services such as home visits was likely the same. Care provided by nurses was likely to result in at least equal health-care costs compared to care delivered by doctors.

Implementation of nurse practitioners in primary care

We conducted a qualitative study to gain insight into factors influencing the decision of GPs and managers of out-of-hours services to train and deploy NPs within their organization (chapter 3). Motivations and decisions slightly differed between general practices offering care during regular office hours and the out-of-hours services. Our study showed that during regular office hours most NPs were deployed as GPs' substitutes in the care for patients with minor ailments in order to decrease the workload of GPs. In addition, NPs were deployed as supplements to GPs in order to improve quality of care and extend the range of services to patients, for example scheduling extra time for complex patients, improving collaboration with other health-care professionals or the monitoring of targeted patient groups. The decision-making in general practices was a dynamic process with often little planning and clarity regarding professional roles. The willingness to train and deploy an NP was highly influenced by a respected employee's motivation (i.e. practice nurse) to start the master's programme. Also GPs' prior experience with NPs, most often at the out-of-hours service, influenced the motivation positively. Specific knowledge about the NP profession and legislation was often lacking.

In the care during out-of-hours, all organizations aimed to deploy NPs as substitutes for GPs. Often the decision was influenced by the opening of an emergency care access point whereby an increase in patient demands was expected. NPs were deployed to avoid an increased number of shifts by GPs. Often out-of-hours organizations formulated long-term planning and role definitions when changing the

workforce skill mix. Out-of-hours services experienced difficulties in creating support among their members (i.e. GPs from the region) regarding the deployment of NPs or with offering them training during regular office hours.

Impact of nurse practitioners working out-of-hours

We conducted several quantitative and qualitative studies to gain more insight into the impact of NPs working in primary care during out-of-hours (chapters 4 to 7). In these studies we compared teams with different numbers of GPs and NPs and their impact on health-care delivery and resource utilization. Our study showed that more than three-quarters of all patients requiring the out-of-hours service on weekend days could be dealt with by NPs. These results imply that teams with a ratio of up to two GPs and two NPs provide sufficient capacity to deliver care to all patients during weekend days.

Analyses of the care provided by GPs and NPs showed that regardless of team structure, the top four patient complaints was the same for both care providers. Those complaints included skin, musculoskeletal, respiratory and digestive problems. However, there were also differences between the care providers: GPs treated older patients, patients with higher levels of urgency, and more patients with digestive, cardiovascular and neurological complaints. NPs treated more patients with skin and respiratory complaints. GPs' workload did not increase meaningfully in teams with one NP and three GPs, but GPs did experience a more complex caseload in teams with two GPs and two NPs. Overall, NPs worked largely independently and asked advice from a GP in less than five per cent of the consultations.

This thesis also indicated some areas of concern when implementing NPs in out-of-hours primary care teams. First, as a consequence of NPs treating fewer patients per hour than GPs, the capacity of teams with NPs was less compared to teams with only GPs. When in a team with four health-care providers the NP–GP ratio was increased by one extra NP, the total number of consultations per team per shift decreased by approximately 3.7 per cent (which is equal to three patients per regular shift from 9 am to 5 pm). Reasons provided by NPs for the fewer consultations included more extensive provision of information and health advice, less delegation to medical assistants and less experience compared to GPs. Second, teams with more NPs were associated with an increased number of patients who did not receive care within the targeted time period. Although there were no adverse events reported in any of the teams, this might have had negative implications for patient safety. Third, the

outcomes of resource use and health-care costs showed conflicting results. The impact of teams with NPs on health-care utilization remains, therefore, uncertain.

Collaboration in health-care teams appeared increasingly important when the number of NPs in the team increased. Teams with three GPs and one NP could deliver care to all patients even if health-care providers did not change their professional routines during the shift. With the extension of NPs in the team (two NPs and two GPs) a lack of collaboration between the care providers in the teams increased the risk in delay for patients who had an appointment with the out-of-hours service. Successful collaboration included the collective identification of patients' needs, effective use of GPs' and NPs' skills, and communication about how to collaborate and share the caseload. Lack of clarity regarding the NPs' scope of practice, lack of knowledge about legal regulations and differences in GPs' support for the NP role had a negative influence on collaborative practice during out-of-hours care. Because team members in out-of-hours care differed in each shift, there was not sufficient time to develop adequate team collaboration.

METHODOLOGICAL REFLECTIONS

To meet the objectives of this thesis we used several research methods: a systematic literature review, quantitative studies and qualitative studies. These studies together give a broad understanding of the implications and impact of the deployment of NPs in primary care. Specific limitations of the various studies have been discussed in the other chapters of this thesis. In this chapter we focus on the overall methodological strengths and weaknesses.

The main part of this thesis included empirical studies on the deployment of NPs in out-of-hours care. Although these studies were pragmatically designed, the randomization procedure can be considered a strength in decreasing the risk for bias in causal attribution. A limitation is the absence of an explicit theoretical framework in the study design and analysis. The main limitation of the studies was the single-centre design, which reduces the ability to generalize findings to other settings. Our research may be best considered a proof-of-concept study. The rationale of a proof-of-concept study is to explore and demonstrate the viability of a concept or method. It may be noted that the patient population was large and comparable to those found in other out-of-hours services in Western countries (i.e. the prevalence rates of type and urgency of complaints).¹⁻³ Bias might have appeared due to the small number of participating NPs. Personal preferences and work experience can influence work attitude and outcomes. Small numbers of NPs is a characteristic of most studies on NP

practice. Despite the limitations, given the similarities of our studies in out-of-hours care with the outcomes of our review, we were able to examine the proof of concept with a reasonably low risk of bias.

This thesis is especially strong in the comparative evaluation design of health-care teams with NPs and GPs. It was not designed for a comparison between the NP and GP profession. The implementation of NPs in health-care teams has an influence on the whole team functioning. Comparing the GP profession with the NP profession would likely have biased the outcomes, because the functioning of both sets of professionals in the team also means each depends on the other.

Global differences in NPs' level of education, requirements for previous work experience/ the training and curriculum of the training of nurses put a strain on the generalizability of research findings.⁴ Moreover, countries differ in legal regulations and scope of practice for NPs. In addition, there are major differences in the implementation of NPs between countries. In contrast to the United Kingdom, United States, Canada and Australia, in many countries the NP role in primary care is relatively new (including in the Netherlands) or even non-existent.^{5,6} The number of years' experience with NPs in primary care is likely to influence the outcomes. In our studies on the out-of-hours care setting, the NPs had little work experience whereas the GPs in general had several years of work experience in the out-of-hours service. This may have influenced, for example, outcomes on resource use.

DISCUSSION OF MAIN FINDINGS

Although the position of NPs in primary care has been a topic of debate amongst GPs and national representatives of GPs, NPs are globally a rapidly growing workforce with the potential to meet current problems in health-care delivery. The NP profession was introduced in the Netherlands in 2001.⁷ Since then, the growth of the NP workforce in the Netherlands has been substantial, from 0.9 NPs in 2009 to 14.7 NPs per 100,000 population in 2014. In comparison, in 2015, the physician workforce was 416 per 100,000 population. The yearly growth rate of NPs was nine times higher than the physician workforce.⁸ This is the most rapid increase compared to other countries and gives the Netherlands the highest rate of NPs per population after the United States.⁸ Of all NPs working in the Netherlands, less than ten per cent work in primary health care.⁹ In this paragraph the motives for deploying NPs and the impact of NPs in primary care will be further discussed.

Motives for deploying nurse practitioners

The education and deployment of NPs has been supported by several measures of the Dutch government. Universities of applied sciences receive funding for the Master Advanced Nursing Practice from the Ministry of Education, Culture and Science in order to stimulate the programme by keeping the costs for students and organizations relatively low.¹⁰ In 2013, additional financial support was offered by the Ministry of Health, Welfare and Sport to expand the number of training places for NPs and physician assistants (PAs) by 75%.¹¹ Moreover, financial support has been offered for research and for the transfer of knowledge on the skill mix of NPs and PAs.¹² Next, a temporary legal basis was formed allowing NPs and PAs to independently indicate and perform reserved medical procedures (i.e. catheterization, cardioversion, defibrillation, endoscopy, injection, puncture, prescribing medicines and simple surgical procedures) in his/her area of expertise. Those procedures were formerly reserved by law for physicians, dentists and midwives and to those who may, under certain conditions, perform the procedure on the orders of those with direct authorization.^{13,14} After the evaluation in 2015,¹⁵ the Dutch government made the legal basis to perform reserved procedures permanent in the Dutch Individual Health Care Professions Act (IHCP Act, in Dutch Wet BIG) from January 2017. The measures of the government were motivated by three goals: 1) as a response to the need to increase the health-care workforce and ageing workforce problems; 2) to improve the quality of health care; and 3) to improve career prospects.¹¹ Another important motivation for most countries in the development of advanced practice nursing includes reducing growing health-care costs.¹⁶ The amount in which the deployment of NPs meets those motivations will be further discussed.

Nurse practitioners as response to workforce issues

The NP role was established in the mid 1960s in the United States as a response to physician shortages in some areas.¹⁷ In the Netherlands, with an average of 4.3 full-time-equivalent (Fte) GPs per 10,000 population, GP shortage is not a large problem.¹⁸ However, an expected growth of 25 per cent of GPs is needed by 2025 because of the ageing population, population growth and feminization of the GP workforce (increase in part-time employment).¹⁹ Appropriate measures are therefore needed to tackle workforce shortages. Possible measures include a regular system of workforce-capacity planning, raising the attractiveness of the profession and increasing the opportunities for task substitution.²⁰ Substitution takes place when other health-care professionals provide the same services as physicians.²¹ This has been the main reason for deploying NPs in our studies. NPs are legally allowed to work as GPs' substitutes

because, in the Netherlands, they are allowed to enter independently into a treatment relationship in his/her area of expertise. This means they can make a diagnosis on the basis of clinical reasoning, followed by making independent decisions about interventions that will be executed. Moreover, they have the authority (and professional responsibility) to indicate and perform reserved procedures.¹⁴ This is a major difference from the widely implemented practice in the Netherlands, which is that bachelor-educated practice nurses take care of patients with chronic complaints following evidence-based protocols. Although tasks are largely autonomously conducted, in contrast to NPs, practice nurses always act under the supervision of a GP and are not authorized to diagnose and prescribe medicine autonomously.⁷ It should be noted, however, that legal regulations of NPs differ between countries, and sometimes even within states, causing variations in the NP role and the potential for GP substitution.⁸

Nurse practitioners to improve quality of health care

Patient demands are not only increasing, but also changing. People get older and live longer independently, there are more patients with chronic complaints, and health-care reforms increasingly shift care from hospitals to the community.^{22,23} Without changing current delivery models, the quality of care is at stake. In order to respond to these changing needs different strategies are possible. To avoid extra burden on GPs, one strategy might be to deploy NPs as supplements for GPs. In this role they provide additional services to extend or complement the services provided by GPs.²¹ In addition, supplementation is aimed at improving quality of care, which has been the main reason in the United Kingdom and the Netherlands behind the growth of NP roles in primary care.^{17,24} A review from Laurant et al.²² suggests that nurses working as supplements results in either no difference or an improvement in clinical outcomes and quality of life compared with GPs working alone.

GPs in our study intended a mixture of substitution and supplementation with the deployment of NPs within their practice. Additional services in primary care might not only focus on medical tasks, but may also include an important care component or non-patient-related tasks. Given their educational training, NPs are able to link the medical and nursing domain. NPs in the Netherlands are educated in competences in accordance with the CanMEDS-system. In practice this means that, as well as providing treatment to a defined group of patients, they can play a role in tasks such as professional development, scientific research, innovation, developing multidisciplinary and transmutal treatment protocols and improving guidelines.¹⁴ Although physicians are also educated according to the CanMEDS-system, they are medically focussed.

Therefore NPs' competences have the potential to be complementary to the GP in meeting changing patient demands and improving the quality of service in primary health care.

Improving career prospects for nurses

Driven by demographic changes in populations as well as changes in patient complaints and lifestyles, there seems to be a need for more emphasis on health promotion, disease prevention, treatment and rehabilitation. Nurses are, because of their vocational training, ideally suited to perform these tasks. However, the nursing workforce is affected by the challenges of shortages.²⁵ In 2005, the International Council of Nurses reported a shortage of 13,000 nurses in the Netherlands and measures to recruit and retain nurses for delivering patient care are needed.²⁶ Most measures include professional and personal support and educational interventions.²⁷ Promotional campaigns in the Netherlands to recruit nurses seem in sharp contrast to the *numerus fixus* that has been introduced in the bachelor of nursing education in 2014.²⁸ Evidence about the success of recruitment and retention measures is lacking. In general, it seems that a package of interventions is more successful than single interventions.²⁷ Deploying NPs as supplements or substitutes for GPs' might put a burden on the scarce nursing workforce. On the other hand, it could be of interest in enhancing education and job opportunities and therefore improve retention for the nursing workforce.^{29,30} In our study, the ambition of a practice nurse and the motivation to keep this employee was for most GPs the main reason to implement the NP role in their practices. Career prospects in direct patient care might prevent nurses from seeking job opportunities outside patient care. The influence of skill mix on the nursing workforce at a macro level is, however, uncertain.³¹

Nurse practitioners to decrease health-care costs

It is a common notion that the deployment of NPs in primary care results in cost savings. However, those cost savings are not supported by the findings in our studies during out-of-hours or in our and others' reviews.^{32,33} The savings on NPs' salary seem offset by longer consultation times and a possible increase in referrals. The costs of health-care are most likely to be equal for NPs and GPs but this does need more rigorous research. Difficulties with cost evaluations include the fact that outcomes might be totally different depending on one's perspective. Societal costs, for example, put a burden on the governmental budget, but less on health insurance companies. Another difficulty is that costs cannot simply be converted between countries.³⁴ Costs

may significantly diverge as a result of the availability of resources, differences in medical treatment patterns and financial incentives, absolute and relative price differences between countries, and health economic guidelines.³⁵

The impact of nurse practitioners on health-care delivery

Extant international research shows positive outcomes for care delivered by NPs.³⁶ Almost all these studies are performed in care during regular office hours. However, current and expected problems in primary care also put a strain on care during out-of-hours. Together with a reduced motivation of GPs to provide 24/7 care and an increased number of primary care contacts taking place out-of-hours, NPs' implementation also has potential in these care settings.^{37,38} However, not only do patients in out-of-hours care differ from those during regular office hours, but so too, in particular, does the organization of both settings differ substantially. Care is provided by small and fixed teams during office hours. In the majority of Dutch practices, GPs work solo or with one other GP.¹⁸ Together with medical assistants (on average 1.2 Fte per practice) and practice nurses (on average 0.3 Fte per practice) GPs form the core team during office hours.^{39,40} Out-of-hours care in the Netherlands is provided in general practitioner cooperatives with 50 to 250 affiliated GPs (members) who share shifts in the evening, night or weekend hours.^{1,41} GPs deliver care together with medical assistants and receptionists in small teams. However, the teams differ every shift, team members are often unfamiliar with each other and typically do not know the patients seeking out-of-hours care.

This thesis shows that, not only during office hours, but also during out-of-hours, NPs have the ability to meet patient demands; to diagnose and to treat patients safely. Our studies focussed especially on the impact on resource use and GPs' workload. A limited focus was put on patient outcomes. Our results were similar to those found in studies during regular office hours and will be further discussed.

Teams with nurse practitioners and the impact on patient outcomes

In contrast to our studies during out-of-hours, a broad range of patient outcomes were included in our systematic review. Several other reviews found similar results to ours in terms of reduction in mortality and an equal or better health status for patients who received care from NPs compared with GPs.^{36,42-44} Factors influencing those outcomes might be an extended patient counselling by NPs and a greater adherence to evidence-based guidelines, which were both found in our review. Although the NPs

in our study during out-of-hours confirmed those factors, this has not been found by all reviews on NPs in primary care.⁴²

Similar to other reviews, we found that patient satisfaction tends to be higher with NPs than GPs. Also during out-of-hours, patients seem at least equally satisfied.⁴⁵ This might be influenced by a greater provision of advice to patients and longer consultation times by NPs.^{36,46} High satisfaction with NP care, however, does not mean that patients inevitably prefer NPs to GPs. The effect size of this outcome varied considerably between studies in our review. Patient preferences were mixed with some patients preferring to see NPs while others preferred to see GPs. Preference may be partly related to the nature of the presenting problem. For example, nurses were found to be preferred for educational or routine aspects of care and GPs for medical aspects.⁴⁷ In addition, patients' willingness to see another health-care professional increases if it gives them quicker access to care.⁴⁸

Teams with nurse practitioners and the impact on resource use

Results from our review and other reviews showed little or no differences between NPs and GPs in the use of resources.⁴⁹ In our study during out-of-hours, we found contradictory results in the frequency of tests, prescriptions and referrals. Other studies show more similarities than differences between the two providers in the decision-making process in patient care.⁵⁰ Due to a lack of follow-up of patients, we could not determine the use of resources and the impact on patient outcomes after the consultation and the efficiency of out-of-hours care.

Another important finding, similar to other reviews, is that the involvement of NPs was associated with longer consultation times.^{32,33,49} Our study during out-of-hours showed that the number of patients per team per shift decreased when more NPs were part of the team. Longer consultation times might relate to the tendency of NPs to give more advice and health information, being more cautious, having less knowledge or fewer years of experience compared to GPs.^{51,52} Other studies found that practice environments, such as being subject to different productivity policies or support from administrators, influence consultation times.^{33,53}

The impact of nurse practitioners on the workload of general practitioners

The implementation of NPs in primary care has the potential to reduce GPs' workload. However, this effect might diminish when GPs continue to provide the type of care that has been transferred to NPs, or NPs provide previously unmet needs or generate

a bigger demand.^{54,55} The effect of NPs' deployment on the workload of GPs therefore remains inconclusive.⁵⁶ In our studies during out-of-hours, NPs were working as GPs' substitutes and did therefore lower the number of GPs' shifts in the out-of-hours service. On the other hand, we found that the complexity of GPs' caseload during the shift increased. It is debatable whether this is a negative development. It might be considered an advantage for GPs and organizations if GPs practise more to the full scope of their medical training.⁵⁷ The standard consultation time per patient might, however, not be sufficient when GPs treat mostly complex patients and might lead to an increase in work pressure if the organization is not changed.

Collaboration in teams with nurse practitioners and general practitioners

In our study regarding the decision of GPs to deploy NPs we found that most GPs did little preparation for the NP role in their organization. Although careful planning is indicated to be important in many studies,⁵⁸ other literature suggests it might be preferable in small practices for the NP role to be flexible and able to evolve.⁵⁹ This is different for large-scale organizations, such as out-of-hours services. We found that out-of-hours services put a lot of effort into planning and role definition in the preparation for deploying NPs. Nevertheless, lack of communication and knowledge about this role definition was common among GPs and was likely to increase the risk of patient delay. Preconceived notions about NPs' roles and training and differences in GPs' willingness to change their professional routines resulted in stagnation in effectively sharing caseloads between NPs and GPs.⁵⁹⁻⁶¹ A major difficulty in the implementation of NPs includes the lack of clarity about the NP role in the public debate, prompted by a diversity in opinions regarding what that role should be.⁶² In addition, unfamiliarity with NPs is likely to put a strain on team collaboration.⁶ Therefore, the current organization of out-of-hours care, in which teams differ between shifts, negatively affects collaboration. Fixed teams might be needed when substituting more GPs with NPs as it is known that ineffective communication and collaboration in teams negatively influences patient outcomes.^{63,64}

IMPLICATIONS FOR PRACTICE AND POLICY

Although several boundaries for the deployment of NPs were taken away by governmental measures, primary care in the Netherlands is still struggling to develop the NP role. A number of implications will be further discussed.

Defining the nurse practitioner role in primary care

Implementing NPs in primary care teams is a complex organizational change but is not always handled as such in practice. Just as in our study during out-of-hours, the implementation of the NP role often takes place within existing organizational structures. NPs often accept the norms of medical care and fit the new role into existing practices rather than challenging these.⁶⁵ A major difficulty for proper implementation of the NP is the (internationally observed) lack of clarification of the NP role and value in primary care.⁶⁶ The added value of the NP is the mixture between care and cure. Deploying NPs as substitutes only, with a main focus on their medical skills is therefore a missed opportunity for the future care delivery model. Rather, the NP role is based on the prior study of the patient population, determination of the need for a new model of care and the identification of problems and goals for primary care.⁵⁸ Only then will organizations have insight into which competences they need to deliver the best care to all patients and NPs will be able to perform meeting the full potential of primary care.

Involving professional associations

Different perceptions about the NP role, their place in health-care settings and scope of practice in health-care teams could impede the expansion and sustainability of the NP role.⁶⁷ In most countries, opposition from the medical profession has been identified as a barrier to successful implementation of NPs.¹⁶ Also a lack of knowledge and experience on the part of NPs influenced GPs' support in our study negatively. To date, GPs' professional organizations in the Netherlands do not formulate a role for the NP in the core primary care team. A shared vision from professional associations (both NP and GP) is a requirement for successful implementation of NPs at a national level.⁶⁸

Nurse practitioners versus physician assistants

In addition to the NP, the PA is a relatively new profession in the Dutch health-care landscape. Like NPs, PAs were introduced in the Netherlands in 2001. Nowadays, compared to 100 Fte GP, there is a 0.7 Fte PA and 1 Fte NP.^{9,69} In the Netherlands, both PAs and NPs are educated to master's degree level. Both professionals need a bachelor's degree plus a minimum of two years of work experience before entering the NP and PA programme. NPs are always nursing educated, while PAs often are as well (44 per cent), but can also be allied health professionals.⁶⁹ Although the education of PAs is based on a medical model and NPs' education on a nursing model, GPs often

do not know the differences between the professions and tasks performed in primary care generally overlap.^{70,71} Studies examining patient outcomes demonstrated equal or improved outcomes where care was provided by PAs or NPs versus care provided by GPs.^{36,55} Also, during out-of-hours the two professionals often perform the same tasks with comparable outcomes.^{45,72} There is, however, little research that compares PA and NP practice outcomes, and firm conclusions regarding the performance of PAs versus NPs in primary care can therefore not be given.⁷³ Similarities between the roles seem to outweigh the differences,^{74,75} which fuels the debate to discontinue the two existing master's programmes and offer one programme instead. Either way, hiring preferences should be based on what background and training best meets the role requirements. As discussed earlier, the outcomes of a prior study of the patient population, determination of the need for a new model of care, identification of problems and goals, and role definitions should indicate those requirements and the decision to deploy either an NP or PA.

Policy measures in out-of-hours primary care

This thesis places the main focus on primary care during out-of-hours. The most important motivation to deploy NPs in this setting was the opening of an emergency care access point. In this organizational model a general practitioner cooperative and an emergency department co-locate. This model enhances the efficiency of the emergency department, but increases the number of patients receiving a consultation at the general practitioner cooperative by approximately 26 per cent.⁷⁶ This thesis shows that substitution is a possible solution to expanding service capacity without putting an extra burden on GPs. Disadvantages include the fact that substitution does not meet possible desires to lower health-care costs and NPs do not practise to their full potential, as most patients during out-of-hours are in need for medically focussed care only. Advantages include the fact that working shifts together with GPs during out-of-hours increases the visibility, knowledge and likely the acceptance of the NP role in primary care in general.

Looking from a different perspective, policymakers should be aware of the effect of increasing supply on demand since demand is not necessarily determined by patients' needs. Although the number of urgent patient cases has increased in recent years, still approximately half of all patients presenting themselves during out-of-hours are not urgent cases, meaning their treatment could wait until the next day.⁷⁷ Given these numbers, instead of increasing the service capacity, measures could be taken to decrease the flow of non-urgent patients during out-of-hours. This can be done by encouraging patients to visit their own GP during regular office hours instead of

attending the out-of-hours primary care service. Measures GPs believed were most helpful in reducing patient demands during out-of-hours included a stricter triage and a larger role for the GP in charge of the telephone consultation. Other measures included patient education, improved telephone accessibility of general practices during office hours, more possibilities for same-day appointments during office hours and feedback about patients' use of out-of-hours care to their own GP.⁷⁸ Some measures, such as co-payments from patients are not only uncertain to be effective but are likely to influence equity in health-care accessibility negatively.^{79,80}

Lastly, it remains uncertain what influence recent reforms, for example in the care for the elderly, will have on out-of-hours services.⁷⁷ At this point, the number of contacts and type of complaints at out-of-hours primary care services have not changed, but expected changes in patient demands due to health-care reforms will influence the care delivery model. In addition, the organization of primary care during out-of-hours should be reviewed together with the care delivered by the emergency department in the hospital and future developments in acute care. Further integration of organizations requires the reviewing of all roles of both primary care and hospital care (emergency nurse specialists' and emergency physicians') and will have subsequent implications for the NP role in out-of-hours care.

IMPLICATIONS FOR EDUCATION

NPs in the Netherlands are educated in accordance with the CanMEDS-system.¹⁴ The CanMEDS-system defines necessary competencies for medical education, including competences as a professional, communicator, collaborator, leader, scholar and health advocate. The master's programme for NPs incorporates a dual work-education model, meaning that students are employed within a practice during their training.⁸¹ However, research shows that the curriculum offered by the universities of applied sciences often does not meet the desire of GPs and NPs for more medical education.⁷⁰ GPs and NPs believe too much time is needed to write reports and perform scientific research and too little time is available to improve clinical expertise.⁷¹ General practices make scarce use of competences in areas such as innovation, scientific research and project coordination.⁷⁰ The master's programme's vision of the NP role seems not to match current practice, leading to conflicting expectations. A dialogue between the universities of applied sciences and GP practices is therefore needed. Universities of applied sciences can communicate the added value of NPs' competences and their considerations in developing the current curriculum. GPs can express their needs in terms of NPs' competences in practice. Universities of applied

sciences are challenged to offer a curriculum meeting current practice and GPs are challenged to make the best use of NPs' competences.

As shown in this thesis, a lack of collaboration between NPs and GPs during out-of-hours care is likely to increase the risk of delay in patient care. Therefore, organizations have to be aware of the need to continuously provide education, resources and support to all team members.⁵⁸ Supporting professionals in inter-professional collaboration at organization level only, however, might not be sufficient to establish sustainable collaboration over time. The ongoing trend towards task-shifting in health-care teams demands added knowledge, skills and attitudes from health-care professionals who are often educated in a discipline-specific way. Although evidence is limited, inter-professional education might be a promising tool with which to equip future health-care providers for effective collaboration in complex health-care teams.^{82,83}

IMPLICATIONS FOR RESEARCH

It is important to realize that the Netherlands has a strong primary care system, which is based on several factors, such as primary care governance, economic conditions of primary care, primary care workforce development, access to primary care and coordination of primary care.²⁰ If the implementation of NPs is desired, it should be approached with care and accompanied by evaluation research. More insight is needed into the long-term benefits or drawbacks of deploying NPs for the core values of primary care as defined by GPs' professional associations, including: a generalist role, person-centred care and continuity in care.⁸⁴ Moreover, sound evidence of the impact on GPs' caseload and the nursing workforce is lacking.

This thesis shows the outcomes of substitution in teams with four health-care providers. Based on the proportion of patients outside NPs' scope of practice during out-of-hours, in theory, a ratio of one GP to three NPs offers sufficient capacity to provide care to all patients presenting on weekend days. In practice, a minimum of two GPs limits the risk of delay in care for those patients who need care from a GP in case of peak flows. This implies that teams of up to eight professionals might provide sufficient capacity if two professionals are GPs and all others are NPs. However, given the longer consultation times associated with NP care and the implications of implementing NPs in collaboration, further research is needed regarding the optimum ratio of NPs and GPs in larger and smaller primary care teams. In addition, research into the impact of NPs in out-of-hours primary care should involve multi-centred studies containing larger numbers of NPs. Longer follow-up periods of patients after

the out-of-hours consultation should provide more insight into the impact on patient outcomes in the long term.

Lastly, although this thesis focussed on NPs, it is also important to acknowledge the PA role in primary care. Substantially less evidence is available on the impact of PAs in (out-of-hours) primary care. In addition, to support GPs' hiring practices more research is needed regarding the impact of NPs versus PAs in primary care.

FINAL CONCLUSION

This thesis shows that substitution of GPs by NPs is a possible solution to meet increasing demands in primary care during regular office hours as well as during out-of-hours. Substitution of care results in at least equal patient outcomes with little or no impact on resource use.

Teams with a ratio of two NPs and two GPs provide sufficient capacity to provide care for all patients during out-of-hours. During regular office hours NPs are not only deployed as substitutes, but also deployed as supplements for the GP, making more use of the competences in their educational training and bridging the gap between nursing and medicine.

Deploying NPs in primary care is a potential answer to future issues regarding the GP workforce, retention of the nursing workforce and improving quality in primary care. The deployment of NPs does not result in lower health-care costs. Knowledge and communication about team members' roles as well as inter-professional education are important to improve collaboration in primary care teams and subsequently patient care.

Research should identify future patient demands and the proper care delivery model that serves patients best. Role standardization and a shared vision from government and professional associations about the NP role is a requirement for further implementation of NPs in primary care.

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Summary

Samenvatting

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SUMMARY

Nurse practitioners (NPs) are increasingly deployed in teams, along with general practitioners (GPs), to help meet the increasing patient demands for primary care. Patients are getting older, living independently at home longer, there are shifts in care from hospital to community, and there is a call for increasing participation of GPs in preventative work in the community. Not only is it debated whether there are enough GPs to meet these increasing demands, but also whether specific tasks can be transferred to other care providers. Internationally, task-shifting between NPs and GPs has been implemented to help reduce the work burden on GPs, which enables GPs to effectively utilise their training and experience by focusing on the most vulnerable and complex patients. Globally, advancing nursing roles in health-care delivery and promoting task-shifting has been supported by policy makers and incorporated into regulatory and educational reforms. In order to enable policy makers to make informed decisions about health-care delivery models, there is a need for evidence concerning the implementation and impact of NPs working in primary care teams.

The content of this thesis is largely based on studies conducted on out-of-hours care. In addition, the thesis includes a systematic review about the impact of nurses as doctors' substitutes and a study of the factors influencing the decision to deploy NPs. This chapter summarises the methods and results of these studies.

Chapter 2 evaluates the impact of nurses working in primary care by means of a systematic review with meta-analyses. Included were 18 randomised controlled trials from seven countries evaluating the outcomes of nurses working as substitutes for doctors. Key outcomes included patient outcomes, processes of care, resource utilisation and costs. Risk assessments were carried out independently by two reviewers. Where feasible, the study results were combined and an overall estimate of the effect was obtained. Other outcomes were evaluated through semi-quantitative synthesis. The outcomes suggest that care delivered by nurses, compared to care delivered by doctors, probably generates similar or better health outcomes for a broad range of patient conditions. Patient satisfaction and quality of life were probably slightly higher in care given by nurses. Results suggest an improvement in processes of care associated with care from nurses, such as patient education and adherence to guidelines. The effect of nurses on resource utilisation was mixed and depended on the type of outcome. Consultation length was probably longer, and scheduled and attended return visits were probably higher for nurses. There was little or no difference between nurses and doctors in frequency of prescriptions, tests,

investigations and in patients' use of other services such as home visits. Nurse – doctor substitution may make little or no difference to the total cost of primary health care.

Chapter 3 describes the results of a qualitative study in which GPs and managers were asked what factors influenced their decision to deploy an NP or physician assistant (PA). The study aimed to provide insights into determinants of the decision-making process, the considerations and arguments to train and employ a PA/NP, and the PA/NPs' tasks and responsibilities. Semi-structured individual interviews were conducted with seven managers of out-of-hours primary care services and 32 GPs who owned a general practice. Both GPs and managers deployed PAs/NPs primarily as substitutes for GPs in the care of patients with minor ailments in order to decrease GPs' caseloads, or to increase service capacity. In addition, GPs intended supplementation of care in order to improve quality or extend the range of services for patients. In contrast to GPs, managers formulated long-term plans and role definitions when changing the workforce skill mix. The GPs' willingness to deploy PAs/NPs was highly influenced by an employees' motivation to start a Master's programme, and the GPs' prior experience of PAs/NPs. Specific knowledge about the PA/NP profession and legislation was often lacking.

In *Chapters 4 to 7*, we report the outcomes of our studies on NPs in out-of-hours care. Out-of-hours care in the Netherlands is organised in large scale general practitioner cooperatives (GPC) in which GPs take turns to work shifts. With changes in patient demands and organisational changes, such as the opening of an emergency access point, more patients are expected in out-of-hours primary care facilities. The deployment of NPs has the potential to reduce the burden on GPs. All our studies were conducted in one GPC that provides care to a population of approximately 304,000 people. More than 150 GPs are affiliated with this GPC and during the study period five to ten NPs were employed by the GPC.

In **chapter 4**, we compared teams comprised of five GPs with teams comprised of four GPs and one NP. Quantitative data were collected from electronic medical records and involved 12,092 patients. The findings showed no difference between the two teams. The NPs saw, on average, 16.3% of the patients and each GP 20.9% of the patients. GPs treated older patients and those with higher urgency levels, and more patients with digestive, cardiovascular, and neurological complaints compared to NPs. The NPs treated more patients with skin and respiratory disorders.

Chapter 5 presents the impact of NPs on resource utilisation. The results were derived from the same trial as described in Chapter 4. The findings showed no difference between teams that included NPs, and teams comprised of GPs only. Nurse practitioners were associated with fewer drug prescriptions and fewer referrals to the emergency department than GPs. The mean production per hour was three consultations for GPs and two and a half consultations for NPs. The cost of a consultation with an NP was less than a consultation with a GP.

Chapters 6 and 7 describe the results of a consecutive trial at the same out-of-hours service in which three different team structures were compared in terms of delivering care: team-1; four GPs, team-2; three GPs and one NP, team-3; two GPs and two NPs.

In **chapter 6** we show that, based on 105 weekend days, of all patients that can be scheduled, an average of 9% is outside NPs' scope of practice. The highest value outside NPs scope in any hour was 40%. The comparison between teams showed that the mean number of consultations per team per shift was lower in teams with NPs, compared to teams comprised of GPs only. The proportion of patients who did not receive a consultation within the targeted time period was significantly higher in teams with NPs, compared to teams comprised of GPs only. The team comprised of two GPs and two NPs referred more patients to the emergency department, compared to teams comprised of GPs only. In addition, we provided insights into the impact of different team structures on GPs' performance features. With more NPs in the team, GPs treated significantly more urgent patients and more patients with digestive complaints. General practitioners in teams with two NPs more often referred patients to the emergency department compared to GPs in GP only teams. Across the overall sample, more than 95 per cent of NPs' consultations were completed without consultation with a GP.

Chapter 7 highlights the specific issues related to collaboration within teams during out-of-hours care, as follows: GPs, NPs and other staff are not necessarily known to each other or the patients who they are treating. Results from the semi-structured interviews, and focus groups involving 38 NPs, GPs and support staff members, showed that collaboration between GPs and NPs is increasingly important when the number of NPs in the health-care teams increases. Factors that influence collaboration included: lack of clarity regarding the NP role and regulations; differences in support for the NP role; variety in team members in sharing caseloads and use of skills; and limited communication about professional roles during the day. Lack of collaboration resulted in an increased risk of patient delay. Because collaboration hardly developed

over time, continuous communication about role definitions and work approach is crucial for successful implementation of NPs.

Chapter 8 comprises a discussion of the main findings of this thesis and the implications for practice, policy, education and research. The results show that, out-of-hours, teams with a ratio of two GPs and two NPs provide enough capacity to provide care during weekend days. The impact of deploying NPs in health-care teams on patient outcomes is expected to be at least equal to teams comprising only GPs. The same results were found for resource use and costs. Given these results, NPs can help meet increasing patient demands in out-of-hours care. However, instead of creating a greater workforce supply, out-of-hours services could also take measures to decrease the amount of consultations with non-urgent patients.

SAMENVATTING

Steeds vaker worden, naast huisartsen, verpleegkundig specialisten ingezet om de stijging van zorgvragen in de eerstelijnszorg op te vangen. Patiënten worden ouder, wonen langer zelfstandig, er verschuiven taken van de tweedelijns naar de eerstelijns en er wordt in toenemende mate een beroep gedaan op huisartsen om deel te nemen aan gezondheidsbevorderende projecten in de wijk. Dit resulteert in een hoge werkbelasting voor huisartsen, waardoor de kwaliteit en toegankelijkheid van de zorg onder druk komt te staan. Het is daarbij de vraag of bepaalde taken ook door andere zorgprofessionals kunnen worden uitgevoerd. Internationaal wordt taakherschikking tussen verpleegkundig specialisten en huisartsen ingezet om de werkdruk van huisartsen te verlichten. Met de inzet van verpleegkundig specialisten komt er voor de huisartsen meer ruimte om zich te focussen op en meer tijd te besteden aan de meest kwetsbare en complexe patiënten in de huisartsenpraktijk. Daarmee wordt ook meer recht gedaan aan de competenties en expertise van huisartsen. Wereldwijd steunen beleidsmakers uitbreiding van verpleegkundige rollen en taakherschikking met nieuwe wettelijke en financiële regelingen en het ontwikkelen van (geaccrediteerde) opleidingen. Om beleidsmakers en professionals onderbouwde beslissingen te laten maken over het gewenste model van (eerstelijns) zorg, waarin ook verpleegkundig specialisten mogelijk een positie kunnen hebben, is er kennis nodig over de implementatie en de effecten van verpleegkundig specialisten in de huisartsenzorg.

De inhoud van dit proefschrift is grotendeels gebaseerd op onderzoeken die zijn uitgevoerd in de huisartsenzorg buiten kantooruren (de spoedpost). Daarnaast bevat dit proefschrift een literatuuronderzoek naar het effect op de zorg wanneer verpleegkundigen taken van huisartsen overnemen en een onderzoek naar factoren die een rol spelen in de beslissing om een verpleegkundig specialist in de huisartsenpraktijk en/of spoedpost in te zetten. Dit hoofdstuk geeft een samenvatting van de gebruikte methoden en de resultaten van deze onderzoeken.

Hoofdstuk 2 evalueert het effect van verpleegkundigen in de eerstelijnszorg door middel van een systematisch literatuuronderzoek met meta-analyses. Het onderzoek bevat 21 gerandomiseerde studies uit zeven landen waarin verpleegkundigen ingezet worden voor taken die voorheen alleen door huisartsen werden uitgevoerd (interventiegroep). De uitkomsten werden vergeleken met huisartsen die vergelijkbare taken uitvoerden (controlegroep). De uitkomsten hadden betrekking op patiëntuitkomsten, processen van zorg, het gebruik van overige zorg en kosten van zorg. Waar mogelijk zijn onderzoeksresultaten gecombineerd in een meta-analyse en is een algehele schatting van het effect berekend. Andere uitkomsten zijn geëvalueerd

door middel van semi-kwantitatieve onderzoeksmethoden. De uitkomsten lieten zien dat zorg geleverd door verpleegkundigen, in vergelijking met zorg geleverd door huisartsen, waarschijnlijk leidde tot vergelijkbare of verbeterde gezondheidsuitkomsten voor een groot aantal gezondheidsproblemen. Patiënttevredenheid en kwaliteit van leven waren waarschijnlijk iets hoger wanneer zorg geleverd werd door verpleegkundigen. De resultaten suggereerden een verbetering in zorgprocessen, zoals patiënteducatie en het navolgen van richtlijnen, geassocieerd met verpleegkundige zorg. Het effect van de verpleegkundige op het gebruik van andere zorg liep uiteen en was afhankelijk van de uitkomstmaat. Zo was de tijdsduur per consult waarschijnlijk langer en het aantal ingeplande en nagekomen vervolgafspraken was waarschijnlijk hoger bij verpleegkundigen in vergelijking met huisartsen. Er was weinig tot geen verschil tussen verpleegkundigen en huisartsen in het aantal medicatievoorschriften, testaanvragen of andere diagnostische onderzoeken en in het gebruik van andere services zoals huisbezoeken. Tot slot leek het overnemen van taken door verpleegkundigen weinig tot geen verschil in zorgkosten te maken.

Hoofdstuk 3 beschrijft de resultaten van een kwalitatief onderzoek waarin huisartsen en managers zijn gevraagd welke factoren de beslissing hebben beïnvloed om een verpleegkundig specialist of een physician assistant op te leiden en in te zetten binnen hun organisatie. Het onderzoek was erop gericht inzicht te krijgen in de determinanten van het besluitvormingsproces, de overwegingen en argumenten om een verpleegkundig specialist of physician assistant in te zetten en de taken en verantwoordelijkheden van de verpleegkundig specialist of physician assistant. Semigestructureerde interviews zijn uitgevoerd met zeven managers van spoedposten en 32 huisartsen van dagpraktijken. Zowel huisartsen als managers zetten de verpleegkundig specialist of physician assistant in voor de zorg voor patiënten met enkelvoudige klachten om de werkdruk van huisartsen op het spreekuur te verlagen of om de capaciteit van de spreekuren uit te breiden. Daarnaast hadden huisartsen de intentie om de verpleegkundig specialist of physician assistant in te zetten voor aanvullende zorg om de kwaliteit van zorg te verbeteren of om nieuwe diensten in de praktijk aan te bieden. In tegenstelling tot de meeste huisartsen, formuleerden de managers een langetermijn-plan en rolbeschrijving wanneer zij een verpleegkundig specialist of physician assistant inzetten. De motivatie van een huisarts om een verpleegkundig specialist of physician assistant in te zetten kwam vaak doordat een werknemer (praktijkondersteuner) de ambitie had deze opleiding te gaan doen, en/of eerdere ervaring van de huisarts met een verpleegkundig specialist of physician

assistent op bijvoorbeeld de spoedpost. Specifieke kennis over juridische aspecten en de rol van de verpleegkundig specialist of physician assistant ontbrak vaak.

Hoofdstuk 4 tot en met 7 beschrijven de resultaten van onderzoeken op de spoedpost. In Nederland wordt de huisartsenzorg buiten kantooruren aangeboden door grote regionale organisaties waarin huisartsen uit de regio onderling diensten verdelen. Deze organisaties verwachten een toename in het aantal patiënten door enerzijds veranderende zorgvragen en anderzijds organisatorische aspecten. Met het laatste wordt de opening van een spoedpost bedoeld, waarbij de spoedeisende hulp van het ziekenhuis en de huisartsen één ontvangstbalie krijgen en zoveel mogelijk patiënten naar de huisarts worden verwezen in plaats van naar het ziekenhuis. De verpleegkundig specialist heeft de potentie om deze toenemende werkdruk op huisartsen te verlagen. Met de inzet van de verpleegkundig specialisten hoeven huisartsen geen extra diensten te verdelen en mogelijk kan het aantal diensten afnemen waardoor de huisarts zich in voldoende mate kan blijven richten op de zorg in de huisartsenpraktijk. De onderzoeken in hoofdstuk 4 tot en met 7 zijn uitgevoerd op de spoedpost in Eindhoven welke zorg verleent aan een populatie van ongeveer 304.000 mensen. Meer dan 150 huisartsen zijn aangesloten bij deze spoedpost en tijdens de onderzoeksperiodes waren vijf tot tien verpleegkundig specialisten in dienst van de spoedpost.

In **hoofdstuk 4** worden teams vergeleken die bestaan uit vijf huisartsen met teams die bestaan uit vier huisartsen en één verpleegkundig specialist. Kwantitatieve data van 12.092 patiënten zijn verzameld uit elektronische patiëntendossiers. De uitkomsten lieten geen verschil zien tussen de twee teams wat betreft leeftijd, geslacht, urgentie en klachten van patiënten. Binnen het team met een verpleegkundig specialist zag de verpleegkundig specialist gemiddeld 16,3% van de patiënten en elke huisarts gemiddeld 20,9% van de patiënten. Huisartsen behandelden, in vergelijking met de verpleegkundig specialist, vaker oudere patiënten, patiënten met een hoge urgentie en patiënten met klachten aan de spijsverteringsorganen, het hartvaatstelsel en het zenuwstelsel. Verpleegkundig specialisten behandelden vaker patiënten met klachten aan de huid of luchtwegen.

Hoofdstuk 5 beschrijft het effect van de inzet van verpleegkundig specialisten op het aantal medicatievoorschriften, röntgenaanvragen, verwijzingen en kosten van zorg. De data komen uit hetzelfde onderzoek als beschreven in hoofdstuk 4. De uitkomsten lieten geen verschil zien tussen teams met een verpleegkundig specialist en teams met enkel huisartsen. Een vergelijking tussen de zorgprofessionals liet zien dat

verpleegkundig specialisten, in vergelijking met huisartsen, minder vaak medicatie voorschreven en minder vaak patiënten doorverwezen naar de spoedeisende hulp van het ziekenhuis. Het gemiddeld aantal consulten per uur was drie per huisarts en twee en een half per verpleegkundig specialist. De kosten per consult bij de verpleegkundig specialist waren gemiddeld lager dan een consult bij de huisarts.

Hoofdstukken 6 en 7 beschrijven de resultaten van een opeenvolgend onderzoek op dezelfde spoedpost waar drie verschillende teamsamenstellingen zijn vergeleken in het verlenen van zorg: team-1; vier huisartsen, team-2; drie huisartsen en één verpleegkundig specialist, team-3; twee huisartsen en twee verpleegkundig specialisten.

Hoofdstuk 6 beschrijft dat, gebaseerd op 105 weekenddagen, van alle patiënten die ingepland kunnen worden, gemiddeld 9% niet geschikt was voor behandeling door de verpleegkundig specialist. Het hoogste percentage niet geschikte patiënten voor verpleegkundig specialisten was 40 in een uur. De vergelijking tussen teams liet zien dat het gemiddeld aantal consulten per team per dienst lager was in teams met verpleegkundig specialisten in vergelijking met teams met alleen huisartsen. Het percentage van patiënten dat geen zorg ontving binnen de afgesproken responstijd was hoger in teams met verpleegkundig specialisten in vergelijking met teams met alleen huisartsen. Het team bestaande uit twee huisartsen en twee verpleegkundig specialisten verwees vaker patiënten door naar de spoedeisende hulp van het ziekenhuis dan teams met alleen huisartsen. Tot slot is het effect van de verschillende teamsamenstellingen op de werkzaamheden van de huisarts onderzocht. Met meer verpleegkundig specialisten in het team behandelden huisartsen vaker hoog urgente patiënten en patiënten met klachten aan het spijsverteringsorgaan. Huisartsen in teams met twee verpleegkundig specialisten verwezen vaker patiënten door naar de spoedeisende hulp van het ziekenhuis in vergelijking met de huisartsen die werkten in een team met alleen huisartsen. Over het gehele onderzoek genomen, rondten de verpleegkundig specialisten hun consulten in 95% van de gevallen zelfstandig af zonder overleg met een huisarts.

Hoofdstuk 7 beschrijft de specifieke factoren die kenmerkend zijn voor samenwerking op de spoedpost. De spoedpost is anders dan de zorg in de dagpraktijk omdat huisartsen, verpleegkundig specialisten en ondersteunend personeel vaak onbekend zijn met elkaar en met de patiënten die zij behandelen. Resultaten van semigestructureerde interviews en focusgroepen met 38 verpleegkundig specialisten, huisartsen, doktersassistenten en baliemedewerkers, lieten zien dat de samenwerking

tussen huisartsen en verpleegkundig specialisten belangrijker werd naarmate er meer verpleegkundig specialisten in het team werkten. Factoren die de samenwerking beïnvloedden waren: gebrek aan duidelijkheid over de rol van de verpleegkundig specialist en over de juridische aspecten; verschil in mate van steun voor de rol van de verpleegkundig specialist; verschil tussen teamleden in het verdelen van de patiënten en het gebruik maken van elkaars competenties; beperkte communicatie over professionele rollen gedurende de dag. Gebrek aan samenwerking resulteerde in een verhoogd risico van vertraging in patiëntenzorg. Omdat de samenwerking nauwelijks ontwikkelde in de tijd, is communicatie over roldefinities en werkaanpak cruciaal voor een succesvolle implementatie van de verpleegkundig specialist. Hier dient continu aandacht aan te worden besteed, onder andere omdat de samenstelling van de teams iedere dienst anders is.

Hoofdstuk 8 bevat een discussie van de belangrijkste bevindingen van dit proefschrift en de implicaties voor praktijk, beleid, onderwijs en onderzoek. De resultaten lieten zien dat, op de spoedpost, teams met een verhouding van twee huisartsen en twee verpleegkundig specialisten voldoende capaciteit boden om zorg te leveren tijdens weekenddagen. Het effect van de inzet van verpleegkundig specialisten in teams op patiëntenuitskomsten was naar verwachting tenminste gelijk aan teams met alleen huisartsen. Dezelfde resultaten werden gevonden voor het gebruik van overige zorg en zorgkosten. De resultaten lieten zien dat verpleegkundig specialisten kunnen bijdragen aan het opvangen van de toenemende vraag naar zorg buiten kantooruren. Een andere mogelijkheid voor spoedposten, in plaats van het creëren van een groter aanbod van professionals, is het nemen van maatregelen om het aantal consultaties voor niet-urgente patiënten te verminderen.

DANKWOORD

Zonder onderzoekservaring werd ik in 2014 aangenomen als 'onderzoeker taakherschikking eerste lijn'. Bij het zien van de vacature was het voor mij direct duidelijk dat dit mijn volgende baan moest worden. Promoveren in het verpleegkundig vak dat ik na de middelbare school zo vol overtuiging had gekozen. En dat in combinatie met de organisatie van zorg waar ik in mijn werk grote interesse voor had opgebouwd. Ik heb ontzettend veel mogen leren tijdens mijn promotietraject, van statistiek tot presenteren en heb veel kansen gekregen waaronder het volgen van cursussen en het bijwonen van congressen waardoor ik wereldwijd meer van de gezondheidszorg zag.

Nu is het ruim twee en een half jaar later en schrijf ik dit dankwoord. Turend naar de bergen en dorpjes langs de wegen van El Salvador, vergezeld door een zingende buschauffeur. Tijd voor bezinning. Het is gelukt. En wat was mijn promotietraject een fantastische tijd, waarbij ik het zeker niet had kunnen doen zonder de hulp van vele mensen. Sommigen kwamen op mijn pad met kleine stenen, anderen hielpen complete stukken mee bestraten. Welke input zij ook gaven, allen ben ik ontzettend dankbaar voor de bijdrage aan het proefschrift dat er nu ligt. Op deze plek wil ik een aantal van hen in het bijzonder bedanken.

Miranda Laurant, jij was het die mij destijds aannam. Aan het einde van het sollicitatiegesprek vroeg je of ik misschien zelf nog vragen had. Het werd een heel ongemakkelijke situatie waarin mijn tas op schoot belandde en ik maar bleef rommelen om mijn briefje met vragen te vinden. Jij stelde me gerust en zei: 'heel goed dat je het hebt opgeschreven'. Ik was je daar zo dankbaar voor. Het was tekenend want ook tijdens het project bood je me altijd de veiligheid om van een beginnend onderzoeker verder te groeien. Jij was mijn dagelijkse steun en dankzij jouw kennis en gedrevenheid kon ik dit onderzoek zo uitvoeren. Ik ben je ook dankbaar dat je me stimuleerde het maximale uit mijn promotietraject te halen en me onder andere steunde toen ik internationaal ervaring op wilde doen.

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Lusine Poghosyan, my stay in New York has been a great experience. I am so grateful for your warm welcome and for giving me the opportunity to learn more about nurse practitioner practice in the United States and about your research. You're a great inspiration both personally and professionally.

Wil van den Bosch... 'Als het goed is heb je mij niet nodig', zei je tijdens onze eerste kennismaking. Gelukkig ging ook alles goed en werden het leuke uitjes naar jou, waarbij ik niet alleen meer over Lent heb geleerd, maar waarin we ook interessante gesprekken voerden over de huisartsenzorg en promoveren.

Onmisbaar waren alle verpleegkundig specialisten, huisartsen, baliemedewerkers, doktersassistenten en managers van huisartsenposten en huisartsenpraktijken die hebben bijgedragen aan de interviews en als denktank input leverden. Speciale dank aan Harrie Geboers en Anita Meeuwsen voor de kans om onderzoek bij jullie uit te voeren en alle bijbehorende organisatorische inspanningen die jullie daarvoor leverden.

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Mijn paranimfen: Marijke Timmermans, ik heb veel gehad aan je kritische blik op het onderzoek en het delen van ervaringen in ons promotietraject. Ook deden we ons eerste internationale congres in Washington samen; herinneringen daaraan maken mij nog steeds aan het lachen. Malou Timmers, het meisje van de studie die vlakbij woonde. Na de opleiding raakten we pas echt bevriend, waarop veel leuke uitjes en weekendjes volgden. Ik vind het heel fijn vind dat jullie tijdens mijn verdediging naast mij willen staan.

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OVER DE AUTEUR

Mieke van der Biezen is geboren op 8 oktober 1985 in Nuland. Na het behalen van haar middelbareschooldiploma in 2002 begon zij met de studie verpleegkunde aan de Hogeschool van Arnhem en Nijmegen. Na het behalen van haar bachelor in 2006 ging zij werken als sociaal verpleegkundige bij de GGD Gelderland-Zuid. Daar werkte zij in de jeugdgezondheidszorg voor de leeftijdsgroep 0-4 jaar. Vanaf 2008 combineerde zij haar werk als verpleegkundige met het volgen van de Master of health and life science; public health aan Maastricht University. In 2010 studeerde zij cum laude af aan de studierichting health education and promotion. Datzelfde jaar ging zij aan het werk als projectleider gezondheidsbevordering en hield zij zich bezig met collectieve preventie op scholen, in wijken en gemeenten. Hiernaast gaf zij vanaf 2011 les aan de verpleegkunde opleiding van de Hogeschool van Arnhem en Nijmegen.



In augustus 2014 startte Mieke haar promotieonderzoek bij het Scientific Center for Quality of Healthcare (IQ healthcare) van het Radboudumc in Nijmegen. Zij was onderzoeker van drie studies naar de inzet van verpleegkundig specialisten en physician assistants in de huisartsenzorg. Zij schreef hierover verschillende rapporten en gaf diverse presentaties op nationale en internationale congressen. Een selectie van resultaten uit deze onderzoeken staan beschreven in dit proefschrift. In het najaar van 2016 werkte zij gedurende twee maanden, in het kader van haar promotieonderzoek, aan Columbia University in New York.

Op dit moment is Mieke werkzaam bij de Academie voor Gezondheidszorg aan de Avans Hogeschool in 's-Hertogenbosch.

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