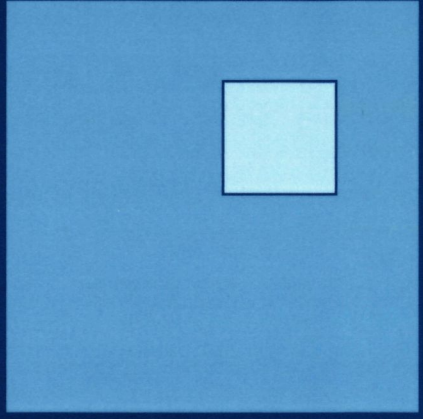
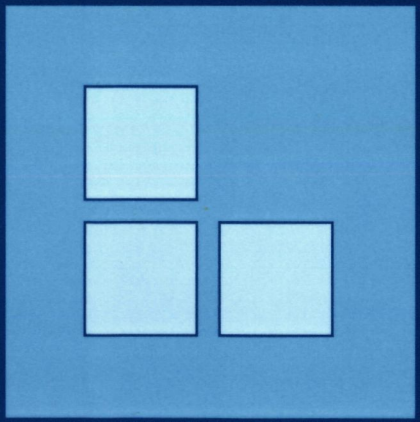


Changes in skill mix

The impact of adding nurses to the primary care team



Miranda Laurant

Changes in skill mix

The impact of adding nurses to the primary care team

Voor mijn vader

"Achter tranen van verdriet
schuilt de glimlach van de herinnering"

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

The studies presented in this thesis have been performed at the Centre for Quality of Care Research (WOK) This centre is part of the Nijmegen Centre for Evidence Based Practice (NCEBP), one of the approved research institutes of the Radboud University Nijmegen and the Netherlands School of Primary Care Research (CaRe), acknowledge by the Royal Dutch Academy of Science (KNAW)

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Changes in skill mix

The impact of adding nurses to the primary care team

Een wetenschappelijke proeve
op het gebied van de Medische Wetenschappen

Proefschrift

ter verkrijging van de graad van doctor
aan de Radboud Universiteit Nijmegen
op gezag van de rector magnificus prof. mr. S.C.J.J. Kortmann,
volgens besluit van het College van Decanen
in het openbaar te verdedigen op dinsdag 11 december 2007
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Maria Geertruida Henrica Laurant
geboren op 2 februari 1971
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Contents

Chapter 1

Introduction

Extended version of:
Laurant M, Sergison M, Halliwell S, Sibbald B. Evidence based substitution of doctors by nurses in primary care? BMJ 2000; 320: 1078.

The focus of this thesis is the *revision of professional roles* in primary care, in particular the shift of specific aspects of general practice care to nurses. *Skill mix change* is another term frequently used for the revision of professional roles, and it refers to a change in mix of skills or competencies possessed by an individual. The thesis focuses on the effects of the introduction of nurses into general practice on the quality of care, general practitioners' workload, patient satisfaction and preference, processes of care, resource utilization, and health care costs.

In this chapter a brief introduction is given to factors governing skill mix changes and to conceptual models of skill mix changes. This will be elaborated in chapter 2. Also, developments relating to skill mix changes in the Netherlands are reported. The chapter concludes by outlining the purpose of this thesis, the research questions and the structure of this thesis.

Factors governing skill mix changes

Pressures to increase the quality of care and to reduce the cost of primary care delivery have led to the redefinition of the roles of health professionals and the creation of new roles such as nurse practitioners, advanced practice nurses, clinical nurse specialists, nurse clinicians, et cetera. In the seventies new nursing roles were seen to be a possible solution to diverse problems in primary care, including rising demands and costs, a shift from hospital care to primary health care, and the changing roles of medical professionals. A decline in medical workforce size, as a consequence of a shift towards part time working,[1,2] has led many to suggest that health services could only be maintained by shifting care from doctors to nurses.[3] As a consequence the nurse's role was redefined and increasingly began to include types of care provision that had been the province of doctors. Nurses learnt new skills, which enabled them to fill previously unmet health needs. Currently nurses perform a wide range of tasks ranging from health assessment to education and to prescribing. Nurses are involved in both preventive care (e.g. prevention of cardiovascular diseases, smoking cessation, hazardous drinking) and chronic disease management (e.g. asthma, COPD, diabetes, mental diseases).[4-6]

Since their initial introduction into the health care delivery system, nurse practitioners have been widely used throughout the United States and Canada, in a variety of practice settings and speciality areas.[7] Ever since, the role of the nurse practitioners evolved in the context of external and internal influences on health care. They function as independent health care providers as well as collaborative members of health care teams.[8] Today - worldwide - many of the tasks previously performed by general practitioners have been taken over by nurses. There is, however, considerable variation between, and sometimes within, countries regarding the training and role of nurses who use the same title.[9]

Models of skill mix changes

It is hypothesized that delivering primary care from a mixed team of doctors, nurses and non-medical professionals offers an attractive model. Doctors and nurses are, together with receptionists and assistants, part of a continuum of care that seeks to optimize health gain from an appropriate use of skills and time of each professional. It allows health professionals to contribute their unique assets towards the attainment of a common goal (Figure 1).[10] Good team working is thought to enhance the quality of care, improve patients' health, constrain costs, and make best use of limited human resources.

Figure 1. Continuum of care from Kernick, 1999[10]

MORE	← ← ← Complexity/uncertainty of task → → → ← ← ← Resource allocation/unit time → → →			LESS
Area A (General Practitioner)	**Area B (Nurse Practitioner)**	**Area C (Extended role Practice Nurse)**	**Area D (Practice Nurse)**	**Area E (Practice Nurse Auxiliary)**
Management and planning treatment on the basis of interpretation and integration of complex clinical, psychological, social, cultural, and cost factors combined with personal experience and knowlegde of patients. Organizing and coordinating a multidisciplinary team	Clinical diagnosis and treatment of less complex presentations. Some areas of chronic care Interaction with other members of the primary health care team.	Well-defined protocol-directed clinical care in specific areas: e.g. asthma, HRT, contaception management.	Traditional nursing care: e.g. immunization, ulcer management, management of minor injuries	Simple, well-defined tasks that can be undertaken with limited training e.g. urine analysis, simple dressings.

Skill mix changes may be grouped according to the type of organizational process employed to bring about change (enhancement/supplementation; substitution; delegation; innovation) or according to the changed boundary between different patient services (transfer; relocation; liaison). Skill mix change is often complex, involving interdependent changes in a number of these facets.[11] (See also chapter 2)

This thesis focusses on the following two skill mix change models:[11-12] nurses may either work as general practitioners' *substitutes* or as general practitioners' *supplements*. Nurses working as general practitioners' substitutes provide services which otherwise would be provided by doctors alone. The primary aim is to reduce the demand for general practitioners. Delegation is another frequently used term for subsitution, but delegation is about shifting care provision from a senior/higher grade to a junior/lower grade person within the same profession, whereas substitution occurs when one type of professional (e.g. doctor) is exchanged for another type of professional (e.g. nurse). In contrast, nurses

working as general practitioners' supplements provide services which complement or extend those provided by general practitioners. The primary aim is to improve the quality of care by extending the range of services available to patients.

Skill mix changes in the Netherlands

In the Netherlands, as in other countries, the professionals employed in general practice have changed over the years. For more than half a century, general practitioners have been supported by so-called practice assistants. Initially practice assistants worked predominantly as receptionists and administrative assistants.[13] The profession of the practice assistant has since evolved and training has been adapted to the changing job description. General practitioners are now likely to delegate more tasks like assisting in the guidance of patients with diabetes, asthma or COPD and those at high risk of cardiovascular disease, provided that the practice assistant is further trained to perform these tasks.[14] Since the eighties, various medical-technical, patient information and organizational tasks have been allocated to them.[14-18] Delegation of these tasks greatly increased between 1998 and 2003.[18] Increasingly the term 'practice nurse' is used instead of the customary 'practice assistant'.

In the early nineties, following Britian's example, a movement to introduce nurse practitioners started.[19-22] A nurse practitioner has a level of education, clinical activity and responsibility higher than that of the practice assistant or practice nurse. A nurse practitioner will work *with* the general practitioner, while a practice assistant or practice nurse will work *for* a general practitioner.[23-24] Nowadays, numerous medical-technical tasks, such as the independent checking of blood pressure, determination of patient risk profiles for cardiovascular disease, and examination and follow up of patients with diabetes and or asthma/COPD are examples of tasks performed by practice nurses as well as nurse practitioners.[18]

Although it's subject of debate we will use the term 'nurse practitioner' in this thesis. It refers to a registered nurse with additional training who has lead responsibility for a defined area of health care in primary care. The nurse works in advanced roles in primary care.

Purpose of this thesis

Ideally skill mix changes and models should be governed by reseach based evidence of how skills may best be distributed among health professionals in order to optimize the cost-effectiveness of health service delivery and improve the quality of patient care.[3] However, although different skill mix change models have been widely implemented, these have not been adequately studied before now (at least at the start of this thesis project in

January 1998). The evidence base for skill mix changes is generally not robust and has lagged behind service developments. A better understanding of the effects of the revision of health professional roles will help policy makers and health care professionals in primary health care to make informed decisions with regard to health delivery services (i.e. the roles and responsibility of different health care professionals with a health care system) and by doing so to optimize the cost-effectiveness of health services delivery and improve quality of patient care.

The purpose of the present thesis is to evaluate the effects of skill mix changes, in particular the shift of specific aspects of general practice care to the nurse practitioner, on quality of care, patient satisfaction and preference, general practitioners' workload, resource utilization and costs.

This thesis is divided into three sections. The first concerns an exploration of factors governing skill mix changes and an exploration of Dutch models in which different types of nurses support the general practitioner in order to optimize health care services. In the second, the results of a clustered randomized controlled trial in which nurse practitioners were added to the general practice team on quality of care, patients' health, satisfaction and preference, and general practitioners' workload are reported. In the third section, the results of two systematic reviews which aimed to synthesize the world literature on the effectiveness of two different skill mix models - substitution and supplemention – are reported. The different research questions and methods are reported in box 1.

Part I Exploration of the concept skill mix changes

Part I of this thesis consists of two chapters. *Chapter 2* provides an overview of factors driving skill mix changes in primary care, the mechanisms of change, and the impact of skill mix changes on care provision, the professionals involved and patient outcomes. It can best be characterized as a narrative study of the literature. It shows that skill mix change is effective in some cases. Whether or not skill mix change is the most appropriate solution to a perceived problem will, however, largely depend on the particular context in which change is comtemplated.

In the seventies and eighties in the Netherlands general practitioners acquired more responsibility for surveillance of their patients as a consequence of shifting secondary care to primary care. It also became widely accepted that patients should be treated at the lowest possible echelon of care without compromising quality. Next to other developments (see chapter 2), these developments led to different models of skill mix changes in the Netherlands. *Chapter 3* focusses on four possible skill mix models in which different type of nurses support the general practitioner. Written questionnaires were used to make an

inventory of these skill mix models. Subsequently, semi-structured telephone interviews were used to gain information about the nurses' roles.

Box 1. Outline of the thesis

Chapter	Research questions	Method
	Introduction	
1	Brief introduction	
	Exploration of the concept of skill mix changes	
2	What is known about factors governing change, mechanisms of change and the impact of skill mix changes on care provision, professionals and patients?	Narative literature review
3	Which skill mix models do exist in primary care and how are these models deployed?	Observational study Questionnaire and Interview
	Impact of skill mix changes in the Netherlands	
4	Which forms of care are delegated to and provided by nurse practioners in general practice?	Randomized controlled trial: Referral & contact sheets
5	What is the impact on general practitioners' workload of adding nurse practitioners to the general practice team?	Randomized controlled trial: Questionnaire & diary
6	What is the effect of adding nurse practitioners to the general practice team on respiratory care? What role does the nurse practitioner perform: substitute or supplement?	Randomized controlled trial: Questionnaire
7	Are patients equally satisfied with nurse-led care compared to doctor-led care? Which factors determine patients'preference and satisfaction with nurse practitioners and with general practitioners?	Cross sectional study: Questionnaire
8	Which factors are related to the successful implementation of nurse practitioners in general practice?	Observational study: Questionnaire & Interview
	Impact of two skill mix change models	
9	What is known about the effects of substitution of primary care on health outcomes, process of care measurements, resource utilization and costs?	Systematic literature review, meta analysis
10	What is known about the effects of suplementation of primary care on health outcomes, process of care measurements, resource utilization and costs?	Systematic literature review, meta analysis
	Discussion	
11	General discussion	Synthesis of results

Part II Impact of skill mix changes in the Netherlands

Nurse practitioners were first introduced in the USA, Canada and UK. In the early nineties, Dutch policy makers, inssurance companies and general practitioners also developed an interest in substituting nurse practitioners for general practitioners in order to address health care problems that, amongst others, included a shortage of doctors, rising health care costs, and increased patient demands. In 1998 a small scale improvement project, in which five nurse practitioners were added to general practices, was implemented. This project was initiated by the Local Association of General Practitioners (DHV Midden Brabant) and Local Community Nursing Authorities (Thebe) and funded by two local inssurance companies (CZ and VGZ). The rationale for this project was the increasing workload of general practitioners and the idea that without extra support the quality of primary care would decrease within a few years. At that time, this was one of the first projects in the Netherlands in which nurse practitioners ('praktijkverpleegkundigen/praktijkondersteuners') were added to the general practice team. As the impact of these nurse practitioners on the quality of care, patients' health, satisfaction and preferences, and general practitioners' workload was for the greater part unknown the effects were evaluated using a cluster randomized controlled trial. The results of this trial are reported in *chapter 4 to 8*. It was hypothesized that the deployment of nurse practitioners would have a positive impact on the general practitioners' workload, on the quality of primary care, and on patients' satisfaction. The chapters describe the tasks general practitioners delegated to the nurse practitioners (*chapter 4*); the effects of adding a nurse practitioner to the general practice team on general practitioners' workload (*chapter 5*); the effects on quality of respiratory care (*chapter 6*); and the effects on patients' preference and satisfaction (*chapter 7*). In *chapter 8* the results of the process evaluation are presented. This chapter gives an overview of factors which may influence the introduction of the nurse practitioner in the Netherlands.

Part III Impact of two skill mix change models

The factors motivating skill mix changes in primary care are many and complex (see chapter 2). Nurses are increasingly employed in advanced nursing roles. It's clear that they have a prominent role in primary health care provision. Nowadays, we can't rule them out. They are inseparably bonded with general practices; taking over part of the work of general practitioners and/or providing a wider range of services to primary care patients. The introduction of nurses into general practice is, however, based on changes in the health care practice instead of research evidence on the effectiveness of skill mix changes. *Chapter 9 and 10* evaluate the effects of two different skill mix models in primary health care. The results of rigorous systematic reviews of research into the impact of nurses

working as substitutes (*chapter 9*) and supplements (*chapter 10*) on patient outcomes, process of care, resource utilization and costs shed new light on the effectiveness and efficiency of skill mix changes in primary care.

General discusion

In *chapter 11* a general discussion of the main findings from the studies reported in this thesis is reported. The main conclusions will be summarized. Next, relevant methodological limitations will be reviewed. This chapter ends with recommendations for future research and health policy.

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Part I

Exploration of the concept skill mix changes

Chapter 2

Changing task profiles

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Changing task profiles. (Chapter 8) In: Saltman RB, Rico A, Boerma W (eds.) Primary care in the driver's seat? Organizational Reform in European Primary Care. Berkshire, England: Open University Press, 2006.

Introduction

Skill mix is a term used variously to refer to the: mix of skills or competencies possessed by an individual; the ratio of senior to junior grade staff within a single discipline; and the mix of different professions within a multi-professional team. General practice shows considerable variation both within and between countries in all these aspects.

General practitioner partnership size is growing in many European countries with consequent role differentiation among doctors. Nurses increasingly are employed to undertake simple clinical tasks such as taking blood samples and syringing ears. In some countries, notably the UK, nurses have moved to more advanced roles in first contact care and the management of patients with stable chronic conditions such as asthma, diabetes and cardiovascular disease. Primary care teams may be further extended through the addition of medical specialists, therapists, or social care workers as in Finland. Other countries are moving in a similar direction. The UK, for example, saw a marked rise over the 1990s in the prevalence of general practices with a mental health counsellor and 'outreach' clinics staffed by hospital-based medical specialists. The Netherlands has introduced policies to enhance collaboration among general practitioners, primary care psychologists and social workers[1]. The dominant trend is towards a more complex skill mix reflected by larger team sizes, increased multi-professional working, and increased role differentiation within teams.

Factors governing change

The factors driving such changes in skill mix are many and complex but may be distilled into the following broad groups:

- wider environment;
- policy;
- payment systems;
- professional regulation and training;
- professional attitudes.

The wider health care environment provides the impetus for change. Rising demand for care, health workforce shortages, and the rising costs of health care provision are powerful factors stimulating the revision of health professional roles. Policy makers respond by articulating the benefits to be achieved through new ways of working. Payment systems and professional regulatory systems determine whether policy will be implemented in practice. The pace of change is moderated by the extent to which professionals need to be retrained and their attitudes to negotiating new roles.

Wider environment

Population aging has placed increasing pressure on health care systems throughout the developed world while, at the same time, medical advances have increased patient expectations. Rising demand and cost of care has led many governments to experiment with cost-cutting reforms. One strategy has been to make general practitioners the 'gatekeepers' to expensive hospital care. A second has been to shift services, such as minor surgery and chronic disease management, from hospitals to general practice. A third strategy has been to shift work from high to low cost health professionals.

Shortages of particular professional groups may additionally accentuate the need to find alternative care providers. In the UK, the Netherlands, and elsewhere in the developed world, the effective size of the general practitioner workforce has fallen consequent on a shift towards part time working accentuated by the increasing proportion of female doctors.[2] As nurses can be trained more quickly and cheaply than doctors, expanding the nurse numbers and extending their role into the medical arena is seen to be an effective strategy for dealing with medical shortages. Similar arguments may be applied to the use of unqualified health care assistants as substitutes for nurses when the latter group is in short supply.

Policy

Multiprofessional teamwork is a widely favoured strategy for addressing the problems created by rising demand and cost. Good teamworking is thought to enhance the quality of care, constrain costs, and make best use of limited human resources. Quality improvements are sought through the enhanced co-ordination of care delivery and by the opportunity for specialization within larger teams. Cost savings are sought through economies of scale and scope, and by shifting care from expensive to cheaper health professionals. Better use of scarce human resources is sought by breaking down disciplinary boundaries which prevent professionals being deployed where their skills can best be utilized. Countries such as Italy, the Netherlands and the UK, and have been persuaded by such arguments to promote the development of larger multiprofessional teams.[3,4]

Payment systems

The successful implementation of policy requires payment systems which reward providers for making the desired changes. Where there is no financial advantage for providers, the pace of reform is likely to be negligible.

In the UK, successive reforms to payment systems for general practice have favoured growth in the size and complexity of general practice teams. The biggest impact was brought about by the 1990 general practitioner contract which gave doctors a budget (i.e.

fundholding) with which to purchase the services of community nurses and other health professionals. General practitioners encouraged primary care nurses to undertake extended roles, largely in the areas of health promotion and chronic disease management.[5] The larger practices were best able to find the money and other resources needed to extend nursing roles, and those practices which enhanced their skill mix in this way were best able to meet the new performance targets attracting payment.[6] Thus economies of scale and scope accelerated growth in team size and complexity. A similar situation prevails in other countries.[7,8]

A closely related issue is whether payers can be billed for the services delivered by non-physicians within primary care teams. In the USA there is considerable variation in whether 'mid-level' providers such as nurse practitioners and physician assistants are able to charge for their services or whether the costs must instead be subsumed as a doctor overhead. Where mid-level practitioners are able to bill for their services, there is a higher prevalence of such providers.[9] A randomized controlled trial examining the effectiveness of substituting nurse practitioners for Ontario family doctors concluded that substitution was not cost effective for family practices because payment systems in the 1970's did not enable doctors to bill fully for the services provided by their nurses.[10] In the Netherlands, a covenant was introduced in 1999 to enable general practitioners to employ nurse practitioners;[11] but numbers have grown slowly due to disagreements about the level of reimbursement.[12]

Professional regulation and training

Governments and professional governing bodies specify the scope of practice for the majority of clinical professionals. These regulatory boundaries influence team composition by limiting the opportunities for extending the role of particular health professionals. The ability to substitute doctors for other health professions is constrained, for example, by the drug prescribing rights permitted to non-physicians. The solution is to change the statutes governing scope of practice. England, for example, has extended prescribing privileges to nurses.[13]

Staff taking on new or extended roles need to be trained for this work. The speed with which skill mix changes can be realized therefore depends on the range of pre-existing skills within a particular health profession and the amount of additional training required to extend those skills. The bigger the gap between existing and desired skills, the bigger will be the investment needed to achieve change and the slower will be the pace of development. Central and eastern European countries wishing to move from a hospital-centred to a general practice-centred health care system have had to develop new systems for training doctors as experts in family medicine – a process which takes many years to

implement.[14] In contrast, the rapid introduction of nurse-led chronic disease clinics in British general practice was facilitated by the high level of skills already possessed by practice nurses and further supported by the provision of short courses. Even so, the pace of service development in the 1990s often outstripped the ability of training programmes to equip nurses for these new roles.[15]

Professional attitudes

A more pervasive factor affecting the pace of skill mix change is the attitude of health professionals to renegotiating new boundaries between themselves and other disciplines. In the UK, general practitioners initially welcomed extended roles for practice nurses where these enabled doctors more easily to fulfil their contractual commitments. This, however, conflicted with nurses' views that modifications to their role should be guided by concerns about developing nursing as an autonomous profession which is complementary, not subservient, to medicine and medical professionals.[16] As the overlap between nurse and doctor roles in primary care has grown, general practitioners have begun to voice concerns that nurses may erode the doctor's role.[17] In the Netherlands, general practitioners have been reluctant to introduce nurse practitioners, preferring to use practice nurses who they have themselves trained. For their part, practice nurses are anxious that nurse practitioners might usurp their role.[18]

Mechanisms of change

Skill mix changes may be grouped according to the type of organizational process employed to bring about change.

Within general practice, skill mix change may be brought about through:

- *Enhancement* – extending the role or skills of a professional group;
- *Substitution* – exchanging one type of professional for another;
- *Delegation* – shifting care provision from a senior/higher grade to a junior/lower grade person within a profession;
- *Innovation* – introducing a wholly new type of worker.

Skill mix may additionally be altered by changing the boundary between general practice and other patient services. This may include:

- *Transfer* – moving the provision of a service to general practice from another health care sector e.g. substituting general practice for hospital care;
- *Relocation* – shifting the venue of a service to general practice from another health care sector without changing the provider e.g. running a hospital clinic in a general practice setting;

- *Liaison* – using medical/clinical specialists to educate and support primary care teams in their care of patients.

In practice skill mix change is often complex, involving interdependent changes in a number of these facets. For example asthma care may be shifted from hospitals to general practice (transfer). In order to support this change, a practice nurse may acquire specialist skills in asthma care (enhancement) enabling her both to extend the range of service provision and reduce the demand on general practitioners (substitution). Routine tasks formerly undertaken by the nurse, such as patient reception, may in turn be delegated to a more junior nurse (delegation) or a non-clinical assistant (substitution). Hospital-based specialist nurses or doctors may continue to advize and support the primary care team in its management of patients (liaison).

Impact on care: role enhancement, substitution, delegation and innovation

The overarching purpose of skill mix change is to improve health care effectiveness and efficiency. The question is whether it does so in practice. The evidence base for change is generally not robust and has lagged behind service developments. Here we review the impact of role enhancement on health care effectiveness and efficiency, substitution, delegation, and innovation within general practice teams.

Enhancement

Health promotion is one of the principal areas in which nurses working in extended roles have increased the range of services available within primary care. In the majority of British general practices, nurses are responsible for carrying out well-patient health checks and providing lifestyle and other interventions in accordance with agreed treatment guidelines.[15] Two large-scale randomized control trials have shown that the benefits to patients of such health promotion do not outweigh the costs.[19,20] The problem is not that nurses are unable to deliver high quality care, but that the treatments they have been asked to deliver are not sufficiently effective.[21]

The situation is more promising in the area of chronic disease management. Here there is good evidence from controlled trials that the treatments to be delivered by nurses are effective. Case studies show also that the quality of care delivered by nurses can be high.[22,23] However surveys of nurses working in extended roles suggest that, in reality, many nurses are insufficiently well trained.[15] More importantly there is a dearth of evidence about the overall cost-effectiveness of nurse-led clinics.[24]

General practitioner roles may also undergo enhancement. Many hold additional qualifications which enable them to provide more specialized services. In the UK, this is

becoming more formal, as general practitioners with appropriate qualifications may apply to become 'general practitioners with special interests' and so receive patient referrals from doctors in neighbouring practices.[25] The intention is to expand specialist care in the community and thus reduce waiting times and improve access for patients. The key question which has yet to be answered is what activities will general practitioners give up to specialize. Does the new balance between generalist and specialist skills result in a more efficient use of resources and increased benefits to patients?

Substitution

The substitution of nurse practitioners for general practitioners is widespread in the USA and becoming so in the UK. In these countries nurses are able to undertake advanced training in diagnostics and therapeutics which enables them to manage a wide range of patient problems without reference to a doctor. Such nurses have increasingly been used to provide first contact care for patients presenting in general practice settings. Systematic reviews of the available evidence suggest that these nurses generally achieve as good health care outcomes as doctors and may have superior interpersonal skills.[26]

The substitution of nurses for doctors might be expected to reduce costs. However, research suggests this is not necessarily so. Compared with doctors, nurses have longer consultation times, order more tests and investigations and may recall patients at a higher rate, thus eliminating net savings in salary costs.[26,27] From the perspective of the health care economy as a whole, it is generally cheaper to train nurses than it is to train doctors, but savings are again eroded because nurses tend to have lower lifetime workforce participation rates than doctors. The net saving to the state is therefore difficult to predict and may differ between countries and over time.

Delegation

Delegation from senior to junior staff within a profession is not a strong feature of general practice which has a 'flat' organizational structure. Nevertheless, when general practitioners come together to practice in groups, there tends to be some degree of differentiation among them in their clinical roles. Female doctors frequently have lead responsibility for managing women's health problems, if only because female patients show a marked preference for female doctors.[28] The general assumption is that such role differentiation within teams can enhance the quality of care provision to patients.[4]

Innovation

New professional designations are introduced by clinical governing bodies to acknowledge, and then regulate, health workers undertaking new roles which require

radical revisions to their training, skills and competencies. The creation of 'nurse practitioners', 'clinical nurse specialists', and 'advanced practice nurses' are good examples. As noted above, such skill mix change centres on revising the work undertaken by existing types of health professionals, so it is arguable whether this should be regarded as 'innovation' or 'enhancement'.

In the USA a unique professional – the physician assistant – has been created. This position is used interchangeably with the nurse practitioner to enhance health service capacity in many areas, notably family practice. Physician assistants are drawn from a wide variety of backgrounds which may include nursing as well as other health or social care workers.[29] Research suggests there is little to distinguish nurse practitioners from physician assistants in terms of the quality and scope of their care or cost-effectiveness when used as doctor substitutes.[29,30] This makes physician assistants an attractive option for expanding workforce capacity when there are shortages of medical and nursing staff.[3,31]

Impact on care: service transfer, relocation, liaison

Skill mix may additionally be altered by changing the boundary between general practice and other patient services. Here we review evidence of the impact of service transfer, relocation, and liaison on health care effectiveness and efficiency.

Transfer

Rising demand and cost of care have led many policy makers to transfer services from hospitals to general practice in an effort to both enhance patient access and constrain expenditure. Good research into the cost-effectiveness of such service transfers is scarce.[32,33] In particular, evaluations generally fail to take into consideration the wider implications of transferring resources from secondary to primary care. If general practitioner referrals to hospitals decline as a consequence of service transfer then the savings in hospital doctors' time may be used for other purposes. This would only be cost-effective, however, if the benefits of these new activities outweighed the benefits of the service transferred to general practice.

In the area of diabetes, a systematic review of available research suggested that that the quality of care attained by general practice was equivalent to that provided by hospitals, provided that general practice care was 'structured' i.e. patient registers were established, patients were recalled for regular review, and reviews were conducted according to clinical guidelines.[34] Other research has shown that patients attending general practice clinics report improved access to care and reduced personal costs, largely through reduced travel times. However, the direct costs of care provision may be higher in general practice

because practices consume more resources than hospitals in providing the same standard of care.[35]

Minor surgery is another service where transfer from hospital to general practice is intended to enhance patient access and constrain cost. This was introduced in the 1990 general practitioner contract in the UK where doctors were given financial incentives to undertake minor surgery. Experience showed that the quality of care provided in general practice was initially poor due to inadequacies in general practitioner training, problems in maintaining surgical skills given low patient volume, and inadequacies in the equipment and/or procedures used to sterilize surgical implements.[36] The only controlled study, however, found no differences in health outcomes between hospital and general practice, with patients treated by general practitioners reporting higher satisfaction and shorter waiting times. The costs of general practice based minor surgery were also found to be lower than those in hospitals.[37] Similar results were found for general practitioners providing diagnostic ultrasound.[38] However, costs were not necessarily 'saved' as the failure to divest in hospital activity while increasing care provision in general practice led to an overall increase in service capacity and costs, rather than a transfer from secondary to primary care as was intended.[39]

Relocation

Adding specialists to general practice teams might be expected to enhance the quality of care and improve access for patients. These benefits have only partially been realized in England, which has experimented with bringing hospital physicians into general practice to provide 'outreach' clinics. A systematic review of research comparing outreach clinics with conventional hospital 'outpatient' clinics found that outreach clinics were not cost-effective.[40] Although outreach clinics enhanced patient access and satisfaction, clinical outcomes were similar and the costs of service delivery were higher because of increased travel time for physicians and the smaller number of patients seen. Other expected benefits, such as the dissemination of knowledge and skills from hospital specialists to general practitioners, were not realized, as the two groups rarely interacted.

Mental health problems form a substantial part of the workload for primary care teams in most countries. The UK and USA have experimented with adding mental health counsellors to general practice teams as a way of both enhancing the quality of care provision and reducing the workload for general practitioners. A systematic review of available evidence suggests that counsellors are as effective as general practitioners in the management of patients with minor mental illness – more effective in the sense that patients treated by counsellors recovered more rapidly than did patients treated by general practitioners.[41] However, research evidence also shows that other anticipated benefits of

attaching counsellors to general practice teams are not fully realized.[42] Specifically, the claims that counsellors might generally reduce general practitioner consultations, prescribing, and out-of-practice referrals for mental illness are not well substantiated. Moreover, the costs of care were not lower when counsellors were substituted for general practitioners in the management of minor mental illness.[41]

Liaison

Using specialists to advize and support general practitioners in their care of patients is another strategy for enhancing the skills of primary care professionals and hence the quality of care provision. A number of models for liaison exist. General practitioners and hospital specialists may enter into 'shared care' agreements which specify the division of responsibility between general practitioner and specialist in the joint management of a patient which the general practitioner would otherwise be unable or unwilling to manage alone. Shared care arrangements have been evaluated in the management of chronic disease (asthma and diabetes). The empirical evidence on cost-effectiveness is mixed. For asthma, shared care used fewer resources.[43,44] There were few differences in clinical and health outcomes, but patients receiving shared care were less satisfied. In diabetes care, most studies reported that clinical and health outcomes were similar to conventional hospital-based care.[45] However the studies that included costs produced conflicting results. Overall, further evidence still needs to be gathered as results seem to be specific to each context and depend on good communication between specialists and generalists.[44,46]

Alternatively, hospital specialists may undertake to improve general practice skills through the provision of education or guidance centred on the care of individual patients. A systematic review of available research into this model of working concluded that 'educational outreach' appeared 'a promising approach to modifying health professional behaviour'.[47] However, the evidence was not robust. Most evaluations of educational outreach focused solely on prescribing behaviour. Only one study measured a patient outcome and few examined cost-effectiveness. A systematic review of research into liaison working in mental health also concluded that there was a dearth of good evidence on which to base any firm conclusions.[42]

Acceptability to patients

How do patients view skill mix change? The answer depends on how their experience of care relates to their expectations - and expectations may vary among individuals, between countries, and over time. Campbell et al.[48] propose that the quality of care for individual patients is determined by *access* (Can patients get to health care?) and *effectiveness* (Is it any good when they get there?). Effectiveness is additionally subdivided into clinical care

and interpersonal care in order to reflect the importance of both for patients. Clinical care is concerned with the technical quality of care delivery and asks whether service provision accords with the best available evidence. Interpersonal care is concerned with the quality of the relationship between patient and practitioner, which is integral to determining whether care is holistic, humane, and person-centred.

Access

Patients report improved access to hospital specialists with shifted outpatient clinics[34] and outreach clinics[40] in general practice. Increased specialization among general practitioners and nurses within general practice teams, together with the addition of other types of health professionals, further increases the range of services and health care expertise available from local general practices.

There are, however, notable disadvantages. Larger team size is known to reduce personal continuity of care and patient satisfaction with access to care. This is because patients find it more difficult to get an appointment with their preferred doctor in larger general practices, although rapid access for acute problems may be easier. Patients favour small practices and full-time general practitioners, which is at odds with the trend in many countries towards larger team size and part time working.[49,50]

Effectiveness

Patient assessments of the technical quality of care are limited by patients' lack of medical knowledge, and hence rarely investigated. Professional assessments of the technical quality of care are reviewed above. Although there is a dearth of good evidence, the findings suggest that the quality of care provision is generally not diminished and may sometimes be enhanced through changes in skill mix.

Patients' assessments of the interpersonal quality of their care have been well researched in the area of doctor-nurse substitution, but not other types of skill mix. Systematic reviews suggest that patients rate the interpersonal skills of nurses more highly than those of doctors.[26] The reason for this is unclear and may relate to a number of factors, including nurses' gender, social status, and consultation length. The great majority of nurses are female and females are often regarded as more 'caring' than males.[51] Nurses tend to have a lower social status than doctors, making them more approachable to patients. In addition, nurses tend to have longer consultation times than doctors and patient satisfaction tends to be higher with longer consultations.[52] It may also be true that nurses, by virtue of their training, have better developed interpersonal skills than doctors.

High satisfaction with nurse care does not, however, mean that patients inevitably prefer nurses to doctors. Patient preferences in most studies are mixed with some patients

preferring to see nurses while others prefer to see doctors.[26,27] Preference may be related to the nature of the presenting problem. Laurant and colleagues[53] found that patients in the Netherlands preferred to see their general practitioner for most aspects of care, although they did favour the nurse for health education/advice and regular health checks. Others have found that nurses are acceptable when the patient believes their problem to be 'minor' or 'routine' but that doctors are preferred when the problem is 'serious' or 'difficult'.[54]

Impact on professionals

Changing the way people work can win commitment from those professionals for whom new opportunities are created.[55] Individuals may feel better supported when they work in teams and good support can offset the stress of high job demand.[56] However restructuring jobs may create losers as well as winners. For example, general practitioners and practice nurses may view nurse practitioners as unwelcome competitors.[18]

In the context of staff shortages, the reorganization of work can be perceived as work intensification[55] and can lead to working longer, more unsocial hours on a routine basis in order to fulfil new remits.[57] The transfer of services from hospitals to general practice will increase primary care workload unless it is adequately resourced.[58,59] Adding nurses to general practice teams may not have the intended effect of reducing general practitioners' workload.[60]

Larger team size increases transaction costs because staff need to spend increasing amounts of time conferring with each other, decreasing the amount of time available for direct patient care.[61] A critical point is reached where transaction costs outweigh the benefits of working in groups. Shared patient record systems, to which all team members may contribute and withdraw information, have been advocated as one means to reduce transaction costs.[62] Electronic medical records are the preferred option as information can be transmitted quickly to whomever and wherever it is needed. However developments in this area are often inhibited by the high initial cost of computerization, the incompatibility of computer systems used by different providers, and concerns about the confidentiality of patient information.[63]

Good teamwork is associated with better quality of care[64,65] but can be difficult to achieve.[66] Redrawing or challenging the boundaries between professional groups and established job roles is a major organizational challenge. Excellent human resource management skills are needed to implement change. Consultation with key stakeholders, good support for middle managers, and continuity of leadership may help to promote success. Clarification of job descriptions and the introduction of induction programmes[67] as well as specific training in teamwork[68] may also prove helpful. Where steps are not taken to

actively manage the transition to multi-professional or team working, tensions are likely to arise and the desired benefits may not be realized.[4]

Conclusion

Skill mix both determines, and is determined by, organizational systems and the wider health care economy. The 'correct' mix of tasks and skills that primary care professionals should undertake is therefore heavily dependent on context.

Skill mix change in one part of the system may impact on other parts with unforeseen consequences. When considering changes to task profiles and skill mix, policy makers need to weigh up and make trade-offs between potential costs and benefits. For example, larger primary care teams may enhance efficiency through improvements in the quality of clinical care, economies of scale and scope, and reduced waiting times for patients. However this may also increase transactions costs, and reduce the continuity of care and patient satisfaction with the interpersonal quality of care.

Policy makers who assume that task profiles and skill mix can be changed within existing budgets are ignoring the complex realities of health professionals' work. Changing existing tasks and skill mix are likely to increase costs in the short term because services are likely to expand into the new area and existing services will contract much more slowly, if at all. It will not be until the longer term, where new tasks and roles are embedded within new jobs and institutions, and where training programmes are changed to reflect these new roles, that gains in efficiency will be forthcoming.

The change in tasks of primary care doctors, and the extent to which they are generalists or are able to specialize, also highlights important trade-offs. Primary care generalists are thought to be the linchpin of a cost-effective health care system as they act as gatekeepers to specialist care. However, where incentives exist for primary care doctors to specialize, what effect will this have on access, on the gatekeeper role, on continuity of care, and on similar hospital-based services? Some countries, with strong primary care-centred health care systems are encouraging their generalist general practitioners to become more specialized (e.g. UK). Other countries, with a strong emphasis on specialist care, are seeking to replace specialists with generalist general practitioners (e.g. Estonia).[69] This emphasizes the role of context in that these opposite reforms may be efficient in their respective countries.

Whether skill mix change is the most appropriate solution to a perceived problem will depend on the particular context in which change is contemplated. Policy-makers and managers need to analyse carefully the nature of the 'problem' they wish to resolve and identify appropriate solutions, taking into consideration the potential wider and long term effects on the system of care. Optimum team size and composition will vary from country to

country and over time, depending on the available mix of health personnel, the labour economy, and the priorities accorded to different aspects of the quality of care provision.

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Chapter 3

The skill mix model does not exist: a study on different skill mix models for general practice in the Netherlands

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Abstract

Background. Primary care is undergoing rapid and substantial changes. In the past decade the roles of professionals (advanced practice nurse, community nurse) have been redefined and new roles (nurse practitioners, nurse specialists) have been created. Ideally doctor-nurse substitution should be based on evidence of how skills are best distributed among professionals. Unfortunately, substitution of care is more often driven by the high demands on general practitioners than by research evidence. A better understanding of different models for doctor-nurse substitution will help general practitioners to make better informed choices. Four models were distinguished: a) advanced or educated practice nurse, b) district nurse, c) nurse practitioners, and d) nurse specialists.

Aim. The following research questions were investigated: 1) What is the frequency of these models in the Netherlands?, and 2) How can these models be characterized?

Methods. A questionnaire was sent to 252 primary health care delivery services, which supposedly were involved in projects in the field of skill mix changes. In addition, ten respondents for each model were interviewed by telephone.

Results. Eighty-two percent of the primary care delivery services responded; 85% were involved in one or more projects. A district nurse worked in most projects and in 33% the doctors received assistance from a nurse specialist. Almost all the nurses were involved in the care of diabetic, Chronic Obstructive Pulmonary Disease (COPD) and asthmatic patients. Practice nurses carried out preventive care and assisted each full-time general practitioner for an average 1½ hours per week. Nurse practitioners carried out different tasks, ranging from health education to the coordination of care. Besides consultation in the practice, they visited the patients at home. A general practitioner could count on 2½ hours assistance per week. Both the nurse specialist and the district nurse had broad job descriptions. They assisted all the general practitioners in a certain region for approximately 1 to 3 hours per week and were available 24 hours a day.

Conclusion. Every skill mix model has its own specific features, although differences were found within each model. Effectiveness studies are needed to demonstrate the effects of these different models.

Introduction

Discussions on the value and implementation of nurse-led services in general practice have been in full swing for a number of years. The care requirements of patients and consequently the volume of care have increased markedly. At the same time, the government has been trying to constrain increases in financial cost. Partly in response to this, the tasks and responsibilities of general practitioners have changed and the workload of general practitioners has increased sharply. The majority of general practitioners are in favour of receiving (extra) support. However, opinions on the most desirable form of support vary widely.[1-11]

Traditionally, general practitioners receive support from practice assistants or practice nurses and there is close cooperation with district nurses. The practice assistants and nurses chiefly offer support with administrative tasks and reception work, while the district nurses visit patients in their homes to cover the areas of "care" and "cure". Both groups of professions have evolved through a process of professionalization, in which their range of work has steadily been adjusted and extended. More emphasis has come to lie on the execution of medical technical tasks and care provision according to agreed protocols.[4,12-17] A fairly recent development in the field of general practice support is the deployment of nurse practitioners and nurse specialists. In various regions of the Netherlands, experiments have been conducted since the nineteen nineties on these forms of general practice support.[4,6,12,18-28]

Current payment contracts give general practitioners the opportunity to employ a 'nurse', although there is poor insight into which form of support provides the greatest benefit. So that general practitioners are able to make better informed choices, an evaluation was carried out of four skill mix models in general practice: a) advanced practice nurses, b) district nurses, c) nurse practitioners, and d) nurse specialists. The following questions were addressed: 1) What is the frequency of these skill mix models in the Netherlands?, and 2) How can these skill mix models be characterized?

Methods

A national postal questionnaire survey was conducted and a proportion of the respondents were approached to take part in semi-structured interviews.

Postal questionnaire to make an inventory of projects in the Netherlands

In the summer of 1999, a self-administered questionnaire was sent to 252 relevant health care institutes: 23 Local Associations of General Practitioners (DHVs), 112 primary health care centres, 21 Diagnostic Centres (TMC/MDC) and 95 certified home care organizations. All these health care institutes were asked whether they were involved in projects in which

the general practitioners could apply for general practice support (i.e. employement of a nurse), divided into the four skill mix models. Data were also gathered on the target groups for whom the nurse provided care. The outcomes are shown in frequency tables.

Semi-structured interview: description of characteristics of ten projects per model

At the beginning of the year 2000, a random sample of the respondents (i.e. project coordinators) were invited to take part in a semi-structured telephone interview. The following items were addressed:

- Background of the project (cooperation, preparation, duration, project initiation);
- The amount of support per general practitioner;
- The skills of the nurse (education and work experience);
- Supervision of the nurse;
- The range of work of the nurse.

The random sample was obtained on the following basis: a) for each project only one respondent could be interviewed, and b) once respondents had entered the sample, they could no longer be approached for another project. Before conducting the actual data collection interviews, four pilot interviews were held. Adjustments were made to the interview protocol on the basis of these pilot interviews. A total of 40 interviews (10 per model) were conducted. The interview comprized open questions. Afterwards, comparable answers were grouped into response categories. Next, the number of times a certain response category occurred was counted. The projects were analysed separately for skill mix model.

Results

Postal questionnaire to make an inventory of projects in the Netherlands

The questionnaire was returned by 82% of the health care institutes (n=206). Four questionnaires could not be included in the analysis because too many relevant data were missing. A total of 85% of the respondents (n=172) were involved in one or more projects in which the general practitioners could apply for nurse assistance.

The largest proportion of the projects were working with district nurses (n=131), followed by nurse practitioners (n=97), and advanced practice nurses (n=80). The smallest proportion involved working with nurse specialists (n=57) (Table 1). Primary health care centres participated in the majority of projects, while home care organizations participated in a considerable proportion. A small number of projects were being conducted with Diagnostic Centres or Local Associations of General Practitioners.

Table 1. Number of projects per health care institute divided over the four skill mix models (absolute numbers)

	District nurse	Nurse practitioner	Advanced practice nurse	Nurse specialist
Primary health care centres (n=85)	64	41	61	28
Home care organizations (n=57)	50	36	6	18
Diagnostic Centres (n=16)	9	9	7	5
Local Association of General Practitioners (n=14)	8	11	6	6
Total	*n*=131	*n*=97	*n*=80	*n*=57

Table 2 shows the target groups who received care from the nurse. The nurse specialists chiefly took on one or two categories of patients, whereas the other nurses provided care for more than two different groups of patients. Diabetes, COPD and asthma patients were the main target groups for nearly all nurses. The advanced practice nurses spent relatively more time on patients with cardiovascular disease and hypertension than the other nurses. Oncological patients formed the largest target group for the nurse specialists and district nurses.

Table 2. Target groups who received care from nurses divided over the four skill mix models (absolute numbers)

	District nurse	Nurse practitioner	Advanced practice nurse	Nurse specialist
	n=131	*n*=97	*n*=80	*n*=57
Number target groups:				
• 1	29	32	27	28
• 2	21	8	19	13
• >2	71	57	34	16
Top 7 target groups:				
• Diabetes	95	74	59	26
• Asthma	79	48	26	10
• COPD	72	50	31	13
• Oncology	40	17	1	18
• Cardiovascular diseases	15	13	24	4
• Hypertension	5	17	32	1
• Dementia	22	15	-	6

Semi-structured interview: description of characteristics of ten projects per model

With the exception of two respondents (replaced by other respondents/project), all those approached agreed to take part in the semi-structured telephone interview. The interview took an average of 30 minutes to complete.

Background of the project

The majority of projects (80%) were cooperative efforts between two or more organizations. In about a quarter of the projects (28%) there was cooperation between the home care organization with the Local Association of General Practitioners or a primary health care centre or a Diagnostic Centre. All the remaining situations involved cooperation with other

institutes or organizations, such as a local group of general practitioners, a hospital, a health insurance company, a university, etc..

With the exception of two projects, all the initiatives started after 1995. The majority of projects with advanced practice nurses and nurse specialists started before 1997, while the projects with nurse practitioners and district nurses often did not start until 1998.

The preparation phase took an average of seven to nine months, with very little deviation from this duration. Projects ran for an average of 18 months with nurse practitioners to 38 months with district nurses.

Amount of support per general practitioner

The number of general practitioners who participated in a project varied from 1 to 400. There was far less variation in the number of nurses per project. One full-time general practitioner could depend on about 2.4 to 3 hours of support per week from a nurse practitioner or a district nurse. The nurse specialists and the advanced practice nurses provided less support: 1.1 and 1.4 hours per week, respectively. In contrast with the advanced practice nurses and the nurse practitioners, various projects with district nurses and nurse specialists provided so-called round the clock care. This meant that a team of nurses covered rotating on-call shifts and also provided care in the evenings and weekends. Nurse practitioners worked the longest hours, on average 18.5 hours per week. Advanced practice nurses supported the general practitioners for the lowest number of hours per week (average 0.9 hours per week). These hours relate only to the extra tasks that were carried out by the advanced practice nurses and not their routine tasks such as administrative-organizational tasks and other relatively simple medical-technical tasks (e.g. removing sutures, vena puncture and ear syringing).[13,14]

Skills of the nurse

In the majority of projects with nurse practitioners and nurse specialists, only nurses with a minimum of two years of experience were employed. Generally, the advanced practice nurses and the district nurses did not have to meet any special standards (Table 3). The majority had already been working as practice assistants, practice nurses or district nurses.

In three quarters of the projects, the nurses received further training. About half of them received this education before starting work at the general practice and 40% were offered various courses during the project. The following topics were addressed: medical technical skills, specific knowledge (disease, treatment) about the target group and communication skills.

Table 3. Preconditions (work experience, training and supervision of the nurses) for the deployment of general practice support divided over the four skill mix models (absolute numbers)

	District Nurse *n*=10	Nurse practitioner *n*=10	Advanced practice nurse *n*=10	Nurse specialist *n*=10	Total *n*=40
a) Experience					
• No	6	3	9	3	21
• 1 year	0	4	1	4	9
• 2-3 year	3	2	0	3	8
• 4-5 year	1	1	0	0	2
b) Education					
• Additional education	5	7	10	6	28
Before employment	*2*	*2*	4	*1*	*9*
During employment	*2*	*5*	*2*	*4*	*13*
Before and during employment	*1*	*0*	*4*	*1*	*6*
c) Supervision					
Number of supervisors					
• None	1	0	0	0	1
• 1 supervisor	6	3	8	3	20
• ≥ 2 supervisors	3	7	2	7	19
Role supervisor[1]:					
• General practitioner	3	4	10	1	18
• Staff member home care organization	6	5	0	5	16
• Project coordinator	1	0	1	4	6
• Medical specialist	0	1	0	0	1

[1] More then one answer possible

Supervision of the nurse

The advanced practice nurses were only supervised by the general practitioners, while the other nurses also often received supervision from a staff member of the home care organization. In 15% of the projects, a special project coordinator was appointed who was responsible for supervising the nurses.

Range of work

Table 4 shows that the majority of patients were referred to the nurses by the general practitioner. It was also evident that the advanced practice nurses themselves selected patients from the practice list. In the projects with district nurses, patients or their families could also make an appointment without prior referral by a general practitioner. The majority of consultations took place at the surgery, followed by home visits and consultations by telephone.

Table 4. Range of work (referral, consultation, patient-related and non-related tasks, standards, guidelines) divided over the four skill mix models (absolute numbers)

	District Nurse *n*=10	Nurse practitioner *n*=10	Advanced practice nurse *n*=10	Nurse specialist *n*=10	Total *n*=40
a) 1st contact[1]					
• Referral general practitioner	9	9	7	6	31
• Initiative patient	6	2	1	2	11
• Practice list	-	2	6	-	8
• Referral medical specialist	2	-	-	5	7
b) Consultation[1]					
• At surgery	7	7	9	2	25
• Home visit	5	8	-	5	18
• By telephone	2	6	-	2	10
c) Patient related task[1]					
• Anamnesis/problem inventory	-	7	3	5	15
• Education and advice	7	7	6	5	25
• Treatment/medical-technical procedures	6	4	2	5	17
• Counseling	5	3	1	5	14
• Follow-up	5	7	10	-	22
• Coordination/Liaison	3	8	1	7	19
d) Other tasks[1]					
• Education/training other professionals	5	3	-	7	15
• Protocol/guideline development	2	5	4	3	14
• Consultation-liaison other professionals	1	2	-	-	3
e) Use of guidelines or standards[1]					
• Yes	8	5	7	7	27
Guidelines Dutch College of General Practitioners	*4*	*3*	*5*	*1*	*13*
Guidelines Home Care Organizations	*4*	*1*	-	*2*	*7*
Other guidelines (e g specialist guidelines)	*1*	*1*	-	*5*	*7*

[1] More then one answer possible

All the nurses gave counselling and advice to the patients. Check-ups and patient monitoring were conducted by advanced practice nurses in all the projects and by nurse practitioners in the majority of projects. The nurse specialists did not carry out these follow-up tasks. Coordination of care and liaison activities were chiefly performed by the nurse practitioners and the nurse specialists. Besides these more or less patient-related tasks, the majority of district nurses and nurse specialists played a role in promoting the professionalism of third parties. About half of the projects with nurse practitioners and advanced practice nurses developed protocols in cooperation with the general practitioners, in which agreements were recorded regarding certain (medical-technical) management issues.

In over three quarters of the projects, the tasks that would be carried out by the nurses had already been set down in a job description before the project started. The tasks in 68% of the projects were based on existing standards and guidelines, such as the guidelines from the Dutch College of General Practitioners (NHG) (33%) and guidelines for home care (18%).

Discussion

Skill mix change is regarded as a way of decreasing the workload of general practitioners and of improving the quality of care. In this study, an inventory was made of the current situation in the Netherlands in relation to different types of skill mix models. Attention was also paid to how support was provided in the different models.

Within primary care, 85% of the health care organizations were involved in projects in which (groups of) general practitioners received assistance from a nurse. Each skill mix model had its own specific characteristics, but within each model, differences were visible between projects.

The *advanced practice nurses* provided support for the general practitioners in terms of preventive care, for example counselling, advising and doing check-ups. In many cases, they were providing care for more than two target groups and they were already working at the general practice. A full-time general practitioner could depend on about one and a half hours of support per week from advanced practice nurses performing extra tasks.

The *nurse practitioners* had a broader range of work than the advanced practice nurses. Besides giving counselling and advice, they took patient histories, made inventories and played an important coordinating role. They often saw patients at home as well as at the surgery. The nurse practitioners were deployed for various target groups. General practitioners could depend on about two and a half hours of support per week.

The *district nurses* also had a broad range of work: from taking patient histories and making inventories of problems, to coordination and liaison activities. As with the nurse practitioner model, care was provided in surgery appointments or home visits. The majority were supporting the general practitioner in the care of more than two target groups for about three hours per week.

The *nurse specialists* chiefly specialized in the care of one or two target groups. They gave counselling and advice and were responsible for the execution of medical technical tasks and the supervision of patients. A full-time general practitioner could request about one hour of service per week from the nurse specialist.

Other striking differences between the skill mix models were found in the working arrangements. The nurse practitioners and advanced practice nurses worked at one general practice or for one local group of general practitioners, whereas the other two types of

nurses worked for all the general practitioners in a certain region. Moreover, the latter often provided round-the-clock services. The nurse practitioners and the advanced practice nurses provided support only during the day.

Within each skill mix model, there were not only shared characteristics but also differences. Nurses within one model did not conduct precisely the same tasks for each target group in each project. Some of the projects provided care for oncological patients, whereas other projects provided care for diabetes or COPD patients. Other differences were for example the number of general practitioners who received support and the supervision of the nurses. Schuller-punt & Delnoij also described these variations.[24]

Limitations & strengths

Projects in the Netherlands were mapped by sending a questionnaire to four different types of health care institutes. For the sake of completeness, it may have been worthwhile to include other organizations, such as hospitals (involvement of specialist nursing care) and health insurance companies. The interviews showed that many of the initiatives were cooperative projects between different types of health care organizations. It was not possible to detect overlap between the projects, because not all the respondents had filled in the name or title of the project. Based on the interviews, there are probably less than 365 projects in the Netherlands. The number of projects needs to be adjusted by about 25%.

Conclusion

As in other countries, skill mix changes seems to have been driven primarily by demands placed on the health care service, such as the heavy workload of general practitioners and changes in primary care. Very little attention has been paid to the benefits of skill mix change for the general practitioners and patients.[29] Effectiveness studies on the different skill mix models, for example on general practitioner workload and quality of care, would contribute to discussions about the relevance of general practice support and the choice of the most suitable support model.

This study provides the first insight into broader characteristics of the different skill mix models in the Netherlands. The findings are intended to fuel ongoing discussions on the deployment of nurses in the Netherlands.

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Part II

Impact of skill mix changes in the Netherlands

Chapter 4

The role of nurse practitioners in general practice? An example

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Abstract

Objective To describe the care provided by nurse practitioners to patients referred to them by general practitioners

Design According to agreed guidelines, general practitioners were able to delegate to nurse practitioners the care of patients with Chronic Obstructive Pulmonary Disease (COPD), asthma, dementia or cancer, and those waiting for admission to a nursing home Nurse practitioners were permitted to undertake the following tasks diagnostic tests, problem identification, health education, guidance of the patient and family, and co-ordination of care For an 18 months period, 30 general practitioners working in 20 general practices and five nurse practitioners recorded information about the management of delegated patients

Results General practitioners referred 1793 patients and the nurse practitioners contacted those patients 9942 times These contacts consisted of consultations in the surgery (14%), consultations by telephone (23%), house calls (42%), and conferences with other providers (e g general practitioner, community nurse) about the patient (16%) The mean number of contacts varied from 2 9 for COPD and asthmatic patients, to 14 6 for patients who had several complaints The tasks delegated by general practitioners to nurse practitioners varied according to the disease of the patient Nurse practitioners shifted from performing diagnostic tests, problem inventories and health education, towards guidance of the patient The number of referrals and consultations increased over the course of the project, while the time spent per consultation decreased The time per consultation varied according to its location In the final six months, nurse practitioners spent on average 31 3 minutes (SD 10 9) per contact in surgery and 36 6 minutes (SD 17 0) per house call Less then 10 minutes were spent on telephone consultations and consultations with other providers

Conclusion Nurse practitioners can support general practitioners, not only in the management of chronically ill patients but also in the care of patients with complex needs

Introduction

Many people expected that the introduction of nurse practitioners in general practice would reduce the workload of the general practitioners.[1] In the USA and UK, nurse practitioners have been providing care for patients with chronic diseases, such as diabetes, asthma, cardiovascular disease and minor illnesses, for a number of years.[2-6] Patients are able to contact the nurse practitioner directly in many cases, without referral by the general practitioners. There is a wide variation in the range of work and training of these nurses.[7,8] Koperski et al. reported that the successful employment of a nurse practitioner depended on good preparation (written documentation of tasks, responsibilities and liability) prior to their actual deployment in the general practices.[7]

In this paper, we describe our experience with a pilot project in which nurse practitioners were added to the general practice team. Before the actual start of the project, the Local Association of General Practitioners (DHV Midden Brabant), Local Community Nursing Authorities (Thebe thuiszorg), and the Centre for Quality of Care Research (WOK), in cooperation with general practitioners in the region, drew up a list of the patient groups for whom the general practitioners could receive assistance from a nurse practitioner. Reducing the workload of the general practitioners was the major criterion in the selection of patient groups. Support facilities were already present for patients with diabetes and cardiovascular disease, so these groups were excluded from this project. Nurse practitioners could be deployed to provide care for patients with COPD, asthma, dementia, cancer and patients on waiting lists for nursing homes, or rehabilitation centres. Tasks that could be delegated to the nurse practitioners by general practitioners were specified in agreed guidelines. The activities in the agreed guidelines were in accordance with NHG guidelines[9-12] and educational materials[13]. Within these agreed guidelines, the general practitioners who participated in the project had freedom of choice regarding the tasks and patient groups that they would delegate to the nurse practitioners.

We studied which tasks the general practitioners actually delegated to the nurse practitioners and which forms of care were provided by the nurse practitioners and to which groups of patients. In addition, we monitored changes over the course of time in delegation and care provision.

Methods

Participating general practices

In September 1998, a one and a half year project was started in Tilburg and the surrounding region, on the effect of deploying nurse practitioners in general practice. Five nurse practitioners were taken on by four local groups of general practitioners with 20 general practices and 30 general practitioners. The local groups of general practitioners

varied in size from six to nine general practitioners. The majority of general practitioners had solo practices (60%) and were working for an average of 33 hours per week. For each full-time general practitioner, 0.84 fte practice assistance was available. A full-time general practitioner had a list of an average of 2611 patients; 65% of the patients had national health medical insurance.

Each local group of general practitioners received 32 to 40 hours of support from the nurse practitioner per week. At one local group of general practitioners, there were two nurse practitioners employed. Nurse practitioners supported the general practitioners in the (medical) management of a number of specific patient groups. The general practitioners referred patients and could delegate the following tasks: diagnostic tests (e.g. lung function tests), taking patient histories, making inventories of problems at home including making an estimate of the care requirement, giving patient education, advice and instruction, counselling patients and their families, and the coordination of care (liaison activities). The tasks and responsibilities of the nurse practitioners were stated in agreed guidelines (Box 1). Nurse practitioners received further training in the care of these patients and in the tasks that they were going to perform (56 hours of educational training). In addition, they learnt how to record consultations in the Computerized Medical Record System (CMRS).

Box 1. Nurse practitioners: a job description

Target population: patients with chronic obstructive pulmonary disease (COPD), asthma, dementia, or cancer or patients on a waiting list for a rehabilitation centre or nursing home
Range of work: supplementary diagnostic procedures (lung function tests, hetero anamnesis, cognitive tests), (systematic) check-ups of chronic diseases, making inventories of problems, patient education, counselling, and liaison activities (coordination of care)
Working method: Firstly, patients were referred to the nurse practitioners by the general practitioners. The general practitioners formulated the care requirement. Referral was done in writing, if necessary with a verbal explanation. After the first visit, the nurse practitioner (usually in consultation with the general practitioners) decided what type of care was required and whether it was necessary for the care to be continued. The nurse practitioners had access to the electronic medical patient files and recorded the most important findings in the medical file of the patient. If necessary, verbal feedback was given to the general practitioner.
Working hours: 32 to 40 hours per local group of general practitioners

Data collection

The general practitioners and nurse practitioners kept detailed records of referrals and consultations in the period from 1 September 1998 to 1 March 2000. Referral cards were filled in by the general practitioners with the following data on the care they delegated: month and year of referral, age and gender of the patient, the disorder of the referred patient, the delegated tasks (e.g. diagnostic test, making an inventory of the home and care situations, education, counselling and/or liaison) and the desired form of contact (e.g. consultation in the surgery, house calls and/or conference with other care providers).

On consultation registration forms, the nurse practitioners noted the following data about the care they provided: month and year of the consultation, care provided (since 1 April 1999), form of contact, duration of the contact, and the completion of care. To detect trends over the course of time, we divided the study duration into three equal periods of six months.

Results

Referral to the nurse practitioners

Number of referrals

Data were recorded on 1793 referred patients (60% women; 49% ≥ 65 years). The number of referrals per general practitioners varied from 11 to 157. Referrals to the nurse practitioner increased as the duration of employment at the general practice increased (Table 1). In the first two periods of six months, the general practitioners referred an average of 84 and 87 patients per month, respectively. In the last six months, the average reached 128 referrals per month, with peaks in referrals in October and November 1999. In these months, the general practitioners chiefly deployed the nurse practitioners for influenza vaccinations (n=153). Even after correction for this, the largest numbers of referrals occurred in the last six months of the project (average 103 per month).

COPD and asthma patients were referred most frequently by the general practitioners, whereas the least frequent referrals were patients on waiting lists for nursing homes or rehabilitation centres (Table 1). The number of referrals for other problems increased strongly as the employment duration of the nurse practitioners increased: 42, 109 and 141 referrals in the first six months, second six months and third six months of the project, respectively.

Delegated tasks

The precise type of care required (e.g. patient education or counselling) depended on the patient group referred (Table 1). In patients with COPD and asthma, the general practitioners chiefly delegated lung function testing and the provision of patient education, instructions and advice. In the other patient groups, the tasks mainly concerned making inventories of problems in the home and care situations and counselling patients. In patients who were on waiting lists, the general practitioners deployed the nurse practitioners relatively frequently for liaison activities and coordination of care.

Table 1. Overview of the number of referrals, delegated tasks and desired form of contact for the total and per patient group in absolute numbers (percentages between brackets)

	Total		COPD/Asthma		Dementia		Cancer		Waiting list		Multiple problems		Other problems[a]	
Number of referrals[b]	1793		901		112		81		47		98		292	
• period 1: 1-6 months	503	(28)	269	(30)	58	(52)	30	(37)	17	(36)	47	(48)	42	(14)
• period 2: 7-12 months	520	(29)	274	(30)	29	(26)	25	(31)	16	(34)	15	(15)	109	(37)
• period 3: 13-18 months	770	(43)	358	(40)	25	(22)	26	(32)	14	(30)	36	(37)	141	(48)
Delegated tasks[c]	1596		851		105		79		47		95		262	
• diagnostic procedures	793	(50)	658	(77)	7	(7)	0	(0)	1	(2)	13	(14)	71	(27)
• inventory	575	(36)	188	(22)	78	(74)	49	(62)	43	(91)	66	(69)	118	(45)
• education	935	(59)	635	(75)	33	(31)	25	(32)	12	(26)	43	(45)	74	(28)
• counselling	395	(25)	62	(7)	63	(60)	59	(75)	27	(57)	52	(55)	106	(40)
• liaison	289	(18)	23	(3)	48	(46)	34	(43)	30	(64)	45	(47)	83	(32)
Desired form of contact[d]	1686		861		107		78		47		85		273	
• in surgery	867	(51)	735	(85)	6	(6)	0	(0)	2	(4)	10	(12)	70	(26)
• house call	722	(43)	116	(13)	85	(79)	61	(78)	40	(85)	62	(73)	172	(63)
• conference	84	(5)	12	(1)	19	(18)	15	(19)	3	(6)	10	(12)	20	(7)
• urgent	95	(6)	12	(1)	12	(11)	15	(19)	4	(9)	14	(16)	30	(11)

[a] Referral concerned patients with other disorders, excluding patients who were referred for influenza vaccination;

[b] In 109 cases, the disorder was unknown; 153 referrals concerned patients who were candidates for influenza vaccination;

[c] In 197 cases, the delegated task was not recorded; 50, 7, 2, 0, 3 and 30 referrals per patient group, respectively; one referral could comprize more than one delegated task;

[d] In 107 cases, the desired form of contact was unknown; 40, 5, 3, 0, 13 and 19 referrals per patient group, respectively; one referral could involve more than one form of contact (e.g urgent and conference).

Desired form of contact

In 1686 referrals, the general practitioners indicated which form of contact was desired (Table 1). The desired form of contact was correlated with the patient's disorder. In COPD and asthma patients, 85% of the contacts took place in the surgery, whereas in other patient groups, this was hardly ever requested (<15%). In 6% of the referrals, the nurse practitioners were instructed to contact the patient or the family within 24 hours. Urgency in particular occurred in patients with cancer or patients with multiple disorders.

Actual care provided by the nurse practitioners

Number of contacts

During the 18 months of the project, the nurse practitioners had 9942 contacts with patients; this varied from one consultation per patient to 101 consultations. The patient who had 101 consultations was a 79-year-old man whose diagnosis was not recorded. He was referred in June 1999. Care of this patient comprized making inventories of the care situation (5 contacts), giving education and advice (3 contacts), counselling the patient and his family (46 contacts), coordination of care (26 contacts) and other tasks (e.g. wound check-ups) (37 contacts). The majority of these contacts were house calls.

In the first six months, second six months and third six months of the project, there were on average 261, 553 and 843 consultations per month (Table 2). The number of contacts per patient group in the 18 months period varied from an average of three contacts in COPD and asthma patients, to 12.5 consultations in waiting list patients.

Care provided

Generally, the most common task performed by the nurse practitioners was giving counselling to the patient and family (Table 2). In the case report, an example is given of the care provided by the nurse practitioner to the partner of a patient with dementia (Box 2). In COPD and asthma patients, a great deal of time was spent providing patient education, instructions and advice. In over one quarter of the contacts, the nurse practitioners performed tasks that were not described in agreed guidelines, such as measuring blood pressure, wound check-ups, medication check-ups and taking blood samples for diabetes check-ups.

Table 2. Overview of the number of contacts per patient, the care provided and the form of contact for the total and per patient group in absolute numbers (percentages between brackets)

Tasks	Total		COPD/Asthma		Dementia		Cancer		Waiting list		Multiple problems		Other problems[a]	
Number of contacts[b]	9942		2716		1267		944		587		1158		1676	
• period 1. 1-6 months	1566	(16)	499	(18)	338	(27)	149	(16)	77	(13)	180	(16)	192	(12)
• period 2 7-12 months	3319	(33)	799	(29)	411	(32)	415	(44)	207	(35)	326	(28)	491	(29)
• period 3: 13-18 months	5057	(51)	1418	(52)	518	(41)	380	(40)	303	(52)	652	(56)	993	(59)
Care provided[c]	7661		1951		854		713		483		909		1374	
• diagnostic procedures	1006	(13)	748	(38)	33	(4)	22	(3)	17	(4)	33	(4)	79	(6)
• inventory	1109	(15)	454	(23)	119	(14)	77	(11)	62	(13)	103	(11)	148	(11)
• education	1699	(22)	932	(48)	132	(16)	67	(9)	68	(14)	113	(12)	185	(14)
• counselling	3142	(41)	654	(34)	370	(43)	394	(55)	181	(38)	423	(47)	638	(46)
• liaison	1739	(23)	240	(12)	242	(28)	217	(30)	185	(38)	255	(28)	301	(22)
• other	2207	(29)	593	(30)	191	(22)	101	(14)	104	(22)	249	(27)	416	(30)
Form of contact[d]	9603		2601		1218		915		571		1128		1630	
• in surgery	1359	(14)	1039	(40)	18	(2)	3	(0,3)	3	(0,5)	18	(2)	138	(9)
• house call	4276	(45)	703	(27)	596	(49)	516	(56)	260	(46)	555	(49)	875	(54)
• by telephone	2313	(24)	324	(13)	398	(33)	266	(29)	194	(34)	343	(30)	392	(24)
• conference	1640	(17)	532	(21)	205	(17)	130	(14)	112	(20)	209	(19)	222	(14)
• urgent	15	(0,2)	3	(0,1)	1	(0,1)	0	(0)	2	(0,4)	3	(0,3)	3	(0,2)

[a] Contacts with patients with other disorders, excluding patients who were referred for influenza vaccination;

[b] In 1403 cases, the patient group was unknown;

[c] In 2281 cases, the care provided was not recorded, including 1652 contacts prior to April 1999; 765, 413, 231, 104, 249 and 302 contacts per patient group, respectively;

[d] In 399 cases, the form of contact was unknown; 115, 49, 29, 16, 30 and 46 contacts per patient group, respectively.

Box 2. CASE REPORT: Care for a patient with dementia and his wife

The general practitioner asked the nurse practitioner to make an inventory of the home situation of a 92-year-old man. Perhaps home care needed to be extended, or day care needed to be arranged for the patient to give the wife a rest. About one year ago, the general practitioner had diagnosed dementia The general practitioner had the impression that partly due to the loss of decorum of her husband the wife could no longer cope with the situation. In preparation for a house call, the nurse practitioner looked for any relevant supplementary data on electronic medical patient file. Then the nurse practitioner made an appointment with the patient's wife. During the first visit, the nurse practitioner gave a description of her job before bringing up the problem Just as the general practitioner had suspected, the wife said that she could no longer cope with the care for her husband. He was becoming steadily more forgetful and was totally ADL-dependant. The wife said that her husband was on the waiting list for a place at a day care centre, but that she had not heard anything for some time. The nurse practitioner noticed that the husband was not following any of the conversation. In order to give the wife a rest, the nurse practitioner agreed to find out whether the husband could be placed in day care and said that she would also contact the RIO to see whether the husband could be admitted to a nursing home for a few weeks. In addition, the nurse practitioner contacted Home Care Services to discuss extending the home care service. The nurse practitioner recorded the information in the electronic medical patient file. In the weekly meetings with the general practitioner, the current situation of the husband and wife was discussed in detail. It turned out that the RIO had not taken any action at all. The nurse practitioner contacted them again and explained the situation. She emphasized the need for urgency and made it clear that the intake consultation could not be postponed any longer. Ultimately, she managed to arrange an intake consultation for the same day. In addition, day care had been arranged and home care was visiting the elderly couple every day to take care of the husband. The nurse practitioner recorded all her contacts with other care providers in the electronic medical patient file Owing to the fact that the situation was deteriorating, the general practitioner decided to apply for a crisis admission at the mental health clinic. When the nurse practitioner contacted the wife by telephone a few days later, she heard that the husband had been admitted to hospital by a locum doctor. The nurse practitioner decided to visit the wife at home for a better view of the situation. The wife was very sad about the way in which her husband had ultimately been admitted to hospital She repeated that she could no longer cope and that she had let the problems all go on for far too long. She was pleased that the nurse practitioner had offered her the opportunity to tell her side of the story and was satisfied about the care that had been provided.

Form of contact and consultation duration

In 9603 cases, the form of contact had been recorded (Table 3). House calls were the most important form of contact. Categorization of the patients according to their disorder showed that consultations in the surgery were the major form of contact in COPD and asthma patients, whereas house calls were the major form of contact in about half of patients in the remaining patient groups.

In 9522 contacts, a note had been made of the duration of the contacts (Table 3). As the employment duration of the nurse practitioners increased, the length of the consultations decreased from 36.6 minutes (sd 25) in the first six months, to 24.9 minutes (sd 19.4) in the last six months of the project.

Table 3. Overview of the average duration (standard deviation) of each contact in total and per form of contact: in minutes

	Total	In surgery	House call	By telephone	Conference
	(n=9522)	(n=1344)	(n=4221)	(n=2273)	(n=1572)
No of minutes per contact	26.1 (20 4)	31.5 (12 8)	38.0 (18.2)	10.6 (9.6)	11.1 (13 0)
• period 1: 1-6 months	36.6 (25 0)	39.5 (16.0)	43 8 (22.3)	18.6 (22 7)	21.8 (24.4)
• period 2: 7-12 months	23 5 (18.1)	27.5 (12 5)	37.0 (16 8)	10.1 (7 4)	10.7 (9.8)
• period 3: 13-18 months	24.9 (19 4)	31.3 (10.9)	36.6 (17.0)	9.6 (5 3)	8.7 (9.7)

The time spent on a contact varied with the patient group and depended on the form of contact. On average, house calls took the most time (38 minutes) and telephone consultations took the least time (11 minutes). In the first six months of the project, the average duration of a telephone consultation and conference with other care providers without the patient was twice as long as in the last six months. The majority of patients remained under the care of the nurse practitioners. Patients who remained under the care of the nurse for one year were invited for a check-up. Other patients visited the nurse practitioner once a week.

Discussion

We investigated which types of support a nurse practitioner could offer a general practitioner, with a particular focus on the tasks that general practitioners actually delegated to the nurse practitioners. The results showed that a nurse practitioner could not only assist the general practitioners with care for patients with chronic diseases (for which a clear protocol was usually available), but could also assist with care for patients with more complex problems. Patient counselling was by far the most important task of the nurse practitioners. The longer a nurse practitioner had been employed at the general practice, the more patients were referred by the general practitioners and the larger the number of contacts per month.

Partly on the basis of experience abroad, we drew-up agreed guidelines for the nurse practitioners in advance, and sent them on training courses before they started work at the general practices. However, we saw that they still needed a starting-up period. Over the course of time, changes took place in the care provided. Firstly, there was shift in the type of care patients received, the longer they were under the care of the nurse practitioner. In the early phase and partly depending on the reason for referral, the focus lay on assisting with diagnostic tests, making inventories and giving patient education. In the later phases, there was more emphasis on patient counselling. Furthermore, the average length of a consultation decreased as the duration of employment of nurse practitioners increased. This can be regarded as a learning process, in which the nurse practitioners needed less time as they gained more experience. Another explanation is that the nurse practitioners became steadily more busy as their duration of employment increased. The majority of patients remained under the care of the nurse practitioner, which meant that there was less time to spend per contact. It can be expected that both these factors played a role. Even in the last phase of the project, the nurse practitioners spent more time on each patient than the general practitioners.

Nurse practitioners were deployed relatively more often for the care of patients with COPD and asthma than for the other patient groups. These disorders were the most

common disorders at the general practices. Prevalence rates of asthma and COPD were 13 and 12-20 per 1000 patients per year, respectively.[9] In contrast, the prevalence of, for example, dementia was 1.1 per 1000 patients per year.[12] Another explanation for the increased deployment is that in comparison with other patient groups, clear protocols were available for the care of patients with COPD or asthma. Thus it was easier to delegate these patients to the nurse practitioners.

There was wide variation in the number of referrals between general practitioners. This was because the general practitioners participated as local groups of general practitioners and not as individual general practitioners. Individual general practitioners within a local group of general practitioners did not necessarily all have the same need for support. In the interviews with the general practitioners and nurse practitioners, it was clear that some general practitioners were not experiencing a heavy workload and therefore did not find it necessary to delegate tasks to the nurse practitioner; other general practitioners were working in solo practices and were reluctant to share their responsibility with the nurse practitioners; some of the general practitioners felt that it was inappropriate to burden patients - particularly cancer patients in the terminal phase - with the introduction of a nurse practitioner; and several general practitioners had difficulty passing on care to someone else.

During the course of the project, a number of general practitioners indicated that they also wanted to delegate the care of other patient groups which were not noted in the agreed guidelines. This might explain the increase in the number of tasks that were not included in agreed guidelines. Where relevant, the general practitioners and nurse practitioners made agreements about such tasks, and a few of them were described in protocols (e.g. hypertension).

National implementation of support workers at general practice

Since 1999, financing has been available for general practitioners who wish to employ nurse practitioners to provide standard general practice care, in particular care for specific patient categories, such as chronic diseases.[14] With the publication of the NHG General Practice Handbook Diabetes Mellitus type 2 [15] and the advent of the Handbook for Asthma and COPD, an important limiting condition for the deployment of nurse practitioners will be met, namely the availability of a job description. Extension of general practice handbooks on other common disorders is an obvious next step. The job descriptions give nurse practitioners a good basis and also the opportunity to follow further educational courses. Nevertheless when nurse practitioners are deployed on a large scale, it must be taken into account that they will need a habituation period before they become fully effective.

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Chapter 5

Impact of nurse practitioners on workload of general practitioners: randomized controlled trial

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Abstract

Objective. To examine the impact on general practitioners' workload of adding nurse practitioners to the general practice team.

Design. Randomized controlled trial with measurements before and after the introduction of nurse practitioners.

Setting. 34 general practices in a southern region of the Netherlands.

Participants. 48 general practitioners.

Intervention. Five nurses were randomly allocated to general practitioners to undertake specific elements of care according to agreed guidelines. The control group received no nurse.

Main outcome measures. Objective workload, derived from 28 day diaries, included the number of contacts per day for each of three conditions (Chronic Obstructive Pulmonary Disease (COPD) or asthma, dementia, cancer), by type of consultation (in practice, telephone, home visit), and by time of day (surgery hours, out-of-hours). Subjective workload was measured by using a validated questionnaire. Outcomes were measured six months before and 18 months after the intervention.

Results. The number of contacts during surgery hours increased in the intervention group compared with the control group ($P < 0.06$), particularly for patients with COPD or asthma ($P < 0.01$). The number of consultations out-of-hours declined slightly in the intervention group compared with the control group, but this difference did not reach significance. No significant changes became apparent in subjective workload.

Conclusion. Adding nurse practitioners to general practice teams did not reduce the workload of general practitioners, at least in the short term. This implies that nurse practitioners are used as supplements, rather than substitutes, for care given by general practitioners.

Introduction

Demand for general practitioners' services has increased in many Western countries because of ageing populations, rising expectations of patients, and reforms that shift care from hospitals to the community. To accommodate this expansion in workload many countries have sought to shift care from general practitioners to other health professionals, notably nurses.[1,2] The presumption is that aspects of care provided by general practitioners could be provided by nurses instead.[3–5] Nurses can undertake much of the health promotion work of general practice[6,7] and have a leading role in the routine management of chronic diseases such as asthma, diabetes, and coronary heart disease.[8–10] Depending on the complexity of tasks, degree of autonomy, and level of training, care may be provided by nurse practitioners, practice nurses, or care assistants.[11]

A review of available research has shown that nurses can achieve health outcomes that are as good as those of general practitioners and that they may have superior interpersonal skills.[12] It is unclear, however, whether nurses reduce the workload of general practitioners. Nurses may supplement or extend general practitioner care rather than substitute for it. We measured the impact of adding a nurse practitioner to the general practice team on general practitioners' workload. We anticipated that measures of objective workload, such as consultation rates, would decline if nurse practitioners were used as substitutes for doctors. No such reductions were expected if nurse practitioners were instead used to supplement or extend general practitioner care. In either case general practitioners might report improvements in subjective aspects of workload, such as job satisfaction and work stress.

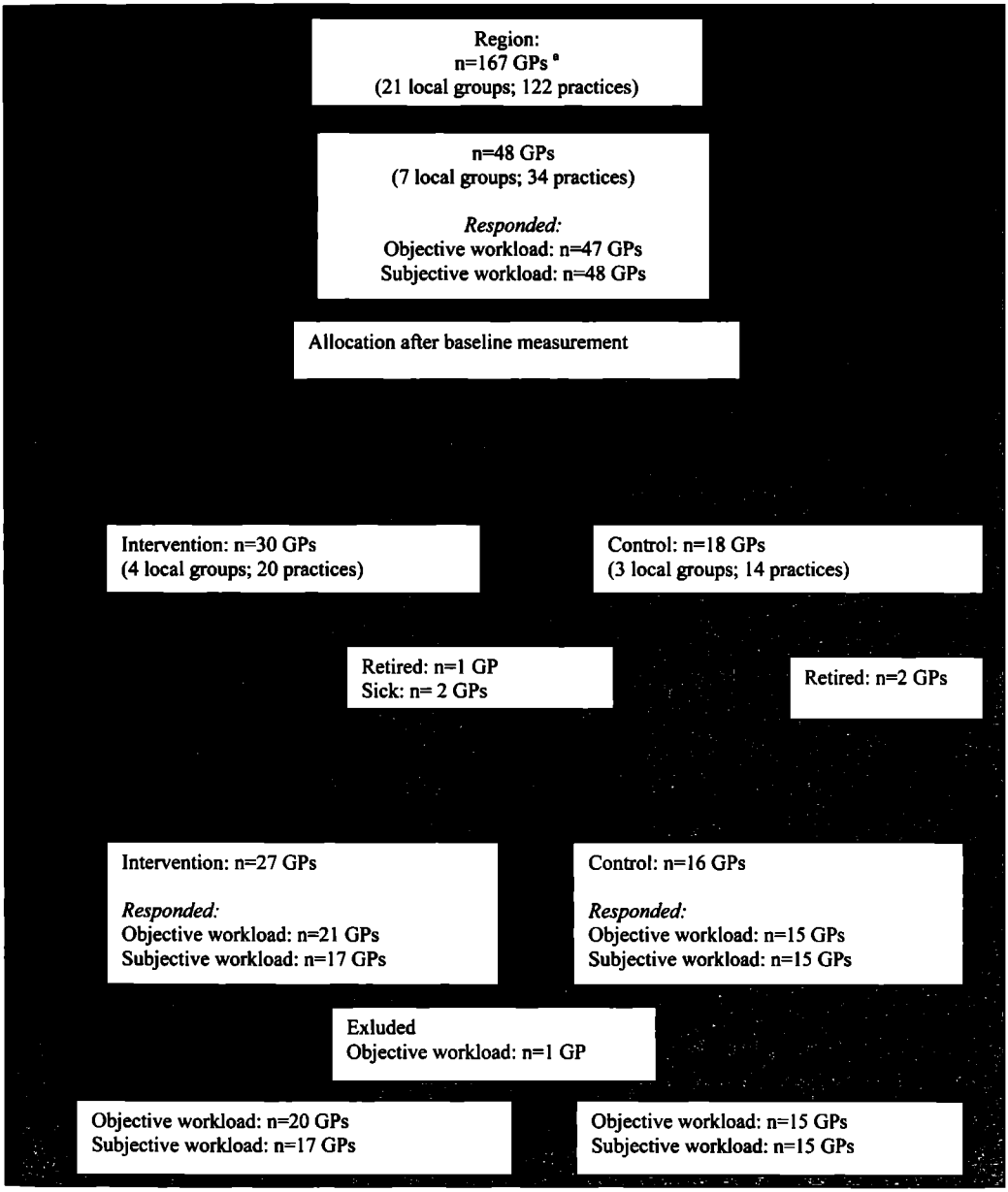
Participants and methods

Design

We conducted a randomized controlled trial of the impact on general practitioners' workload of adding nurse practitioners to the practice team. In the Netherlands general practitioners are organized into "local groups" for the purposes of care out-of-hours and continuing medical education. Regional policy states that each local group should ideally have one full-time nurse practitioner.[13] The Local Association of General Practitioners approached the 21 local groups (167 general practitioners) in a southern region of the Netherlands, and seven of these volunteered to participate (Figure 1).We grouped local groups into matched pairs, using deprivation of the population and rural or urban location of the practices as the matching criteria. We assigned the odd local group to one pair, creating a matched threesome. Next, after baseline measurement, two independent researchers randomly assigned one local group from each pair and two local groups from the threesome to the intervention (four local groups, 30 general practitioners, 20 practices)

by using sealed opaque envelopes. The other local groups were assigned to the control group (three local groups, 18 general practitioners, 14 practices).

Figure 1. Flow of general practitioners through trial



[a] GP=general practitioner

Intervention

We recruited nurse practitioners from the community nursing service and had a mean of 12.1 (SD 3.1) years' postgraduate experience as community nurses. Three nurse practitioners worked full-time (32-36 hours per week), and two shared one job (20 hours per week each). Each nurse served six to nine general practitioners. On average one full-time nurse worked for seven full-time doctors. The nurse practitioners were expected to work cooperatively with the doctors according to agreed guidelines (Box 1).

Box 1. Nurse practitioners: a job description

Target population:
- Patients with COPD, asthma, dementia, or cancer

***Tasks performed according to agreed guidelines* (developed for this study):**
- Performing diagnostic tests (measurement of lung function, cognitive tests, interviewing patients and their family)
- Assessing the patients' health and home situation
- Educating patients and if appropriate the family to explain the disease, prognosis, rationale of treatment, etc
- Performing (preventive) social visits to patients to support the patient and if appropriate the family
- Coordinating the care of patients and making contact with community health services, specialized nurses, or other healthcare professionals

Procedure:
- A patient was referred by a general practitioner to the nurse practitioner
- After the first contact with a patient the nurse practitioner makes decisions on the management of the patient according to the agreed guidelines Four possible courses of action can be taken the nurse takes care of the patient, the nurse and general practitioner share the care of the patient, the patient is referred back to the general practitioner, or the patient does not need care
- The nurse practitioner had access to the (electronic) medical records of the patient and reported the contacts with the patients in the medical records If necessary, the nurse discussed the patient and course of action with the general practitioner

Training:
- Registered nurse with the highest training level (BSc degree) who had worked at least two years as a community nurse
- The nurses followed a special training programme for two weeks before they were introduced to the general practice

Definition of a nurse practitioner:
- Nurses with additional knowledge, skills, and attitudes who take responsibility for the assessment and treatment of patients in primary care [14] They work with, rather than for, a general practitioner They work as co-practitioners and can be seen as collaborative members of the general practice team

Measures

We measured objective and subjective workload of participating doctors six months before and 18 months after nurse practitioners were introduced. We also recorded demographic and practice characteristics for doctors (Table 1).

We measured objective workload by diary. For 28 consecutive days, including evenings and weekends, general practitioners recorded the time they started and finished the working day and, for patients with COPD or asthma, dementia, and cancer separately, the number of consultations in the practice, of telephone consultations, and of home visits. Although we did not assess the validity of the diary, the method is widely used and also proved to be valid in previous studies.[16,17] As reporting bias is likely to have been similar

for both intervention doctors and control doctors, any observed differences between groups are likely to be valid.

We used a questionnaire with proved validity and reliability to measure subjective workload.[18] Four subscales measured satisfaction with the availability of time for practice management (five items), job satisfaction (four items), level of inappropriate demand by patients (four items), and perceived discrepancy between investment and reward (cost benefit) (three items). Each item was rated on a 5-point Likert scale.

Power calculation

Charlton et al.[8] showed a 50% reduction in the number of patients' contacts with general practitioners after the introduction of a nurse run asthma clinic, operating 10 hours per week, in a practice of four doctors serving 8049 patients. A power calculation ($\alpha = 0.05$, power 80%), based on a fall in the number of contacts with general practitioners during surgery hours of 50% of the eligible patients, showed that a total of 21 general practitioners were needed in our study. Given an expected response rate of 70% we needed to recruit at least 30 general practitioners.

Analysis

The unit of analysis was the general practitioner because the intervention was targeted at individual doctors. Although randomization of nurse practitioners was by local group, we had no reason to suppose that the behaviour of doctors within groups would be more alike than the behaviour of doctors in different groups.

For each general practitioner in each observation period we calculated the total number of contacts with patients per week in surgery hours and out-of-hours. We also calculated the number of contacts per week for each of three groups of patients (with COPD or asthma, with dementia, and with cancer); by type of consultation (in practice, by telephone, and by home visit); by time of day (surgery hours, out-of-hours); the number of hours worked per day; and the number of evenings, nights, and weekends on call. We standardised each measure to account for differences between general practitioners in actual hours worked during the day or on call over the study period.

We transformed questionnaire items measuring subjective workload to ensure that a higher score represented a higher perceived workload. We then also computed the average score on each subscale for each general practitioner.

We used analysis of covariance (ANCOVA) for normally distributed data to assess the significance of differences between the intervention and control group. For objective workload the mean number of contacts at follow up was the dependent variable, with the baseline value as covariate. For subjective workload we used the mean score at follow-up

as the dependent variable, with the baseline score as covariate. We used the Mann-Whitney U test where the outcome measures were not normally distributed, with the difference between follow-up and baseline measures as the dependent variable.

Results

Study population

Table 1 summarizes the characteristics of participating general practitioners (n=48). The intervention and control groups were comparable with regard to general practitioners' demographic and practice characteristics at baseline. Participating general practitioners resembled non-participants in the region with regard to sex and type of practice. The study group as a whole resembled general practitioners nationally in terms of age, sex, and characteristics of the practice.[19]

Table 1. Characteristics of the study population at baseline, 1998

Variable	Intervention group	Control group
No of local groups	4	3
No of practices	20	14
No of general practitioners	30	18
No. of male doctors	24	15
Mean age (SD)	44.8 (7 9)	45.3 (8 0)
Mean hours worked per week (SD)	33.9 (8.1)	33.6 (6 9)
Mean No of years since graduation (SD)	15.5 (7.9)	14.9 (8.8)
Mean No of years in current practice (SD)	12.8 (8 8)	13 1 (8 3)
Mean hours support from practice assistants per full-time general practitioner (SD)[a]	33.9 (6.2)	35 4 (10 1)
Mean No of patients per full-time general practitioner (SD)	2595.2 (411.7)	2608 3 (584 0)
Mean No of patients with insurance though national health service per full-time general practitioners (SD)	1703.0 (537 1)	1879.0 (513 6)
No of nurse practitioners	5	0

[a] In the Netherlands most general practices employ one or more practice assistants who take responsibility for administrative and laboratory tasks [14]

Thirty six of the 48 general practitioners completed baseline and follow-up diaries, of whom 35 (73%) were included in the analysis (Figure 1). One doctor was excluded because he worked too few hours in the follow up period (under 40 hours) for workload estimates to be reliable. Thirty two (67%) of the 48 general practitioners completed baseline and follow-up questionnaires.

Objective workload

We found no significant differences at baseline between general practitioners who completed diaries at follow up (n=35) and those who did not (n=12) in their mean number of contacts during surgery hours (z= -0.90, P=0.367) or out-of-hours (z= -1.50, P=0.135).

The number of contacts during surgery hours increased by 4.5 per week over the study period in the intervention group but not changed in the control group (Table 2). The increase was, however, not significant (z= -1.90, P=0.057). The excess of contacts in the intervention group was due to an increase in the number of contacts with patients who had COPD or asthma (z= -2.73, P=0.006).

The number of contacts out-of-hours decreased by 1.5 in the intervention group and increased by 2.1 in the control group (Table 2). The decline in the intervention group was non-significant (z= -1.24, P=0.217).

At baseline and follow-up 80% of the patients with COPD or asthma attended the practice (baseline measurement 169.68 of 214.18 contacts; and follow up measurement 213.87 of 267.63 contacts), whereas 60% of patients with dementia and cancer received home visits (dementia baseline measurement 46.13 of 80.07 contacts, follow up measurement 62.8 of 106.68; cancer baseline measurement 77.76 of 117.51 contacts, follow up measurement 71.25 of 130.15 contacts).

As the intervention group had more contacts for COPD or asthma, they additionally experienced a greater increase in the number of practice based consultations than the control group (z= -3.0, P=0.003; Table 3).

Subjective workload

Table 4 summarizes the mean scores for each of the four aspects of subjective workload. We found no significant differences in questionnaire responses at baseline between general practitioners who completed the follow up (n=32) and those who did not (n=16). The change in subjective workload measures from baseline to follow-up did not differ significantly between intervention and control groups.

Table 4. Subjective workload expressed as a mean score (95% confidence interval) on a 5-point scale[a], before and after the introduction of nurse practitioners

	Intervention group (n=17)		Control group (n=15)			
Scored variable	**Before**	**After**	**Before**	**After**	$F_{3,29}$[b]	**P value[b]**
Available time	2 7 (2.3 to 3.0)	2.8 (2 5 to 3.2)	2.9 (2.6 to 3.2)	2 8 (2.4 to 3.2)	1.19	0.285
Job satisfaction	2 2 (1.8 to 2 5)	2 2 (1 9 to 2 4)	2.3 (1.9 to 2.8)	2.4 (2.1 to 2.7)	0.68	0.415
Inappropriate demands	3.4 (3 1 to 3.7)	3.5 (3.1 to 3.8)	3.4 (3 1 to 3.7)	3 5 (3.1 to 3.8)	0 27	0 608
Cost benefit	2.9 (2.5 to 3.3)	3.0 (2 7 to 3.3)	2 8 (2 3 to 3.2)	2.8 (2.5 to 3.2)	0.51	0.479

[a] Higher score represents higher job stress

[b] Analysis of covariance.

Table 2. Objective workload of general practitioners, expressed as the mean number of contacts with patients per week (95% confidence intervals) per group of patients during surgery hours (standardized by median number of days worked) and out-of-hours (standardized by mean number of shifts) before and after the introduction of the nurse practitioner

	Intervention group (n=20)			Control group (n=15)			
Patient contacts	**Before**	**After**	**Δ[a]**	**Before**	**After**	**Δ[a]**	**P value[b,c]**
Surgery hours	12 9 (9 0 to 16.8)	17.4 (12.4 to 22.4)	+4.5 (0.6 to 8.3)	10.3 (7 6 to 13.0)	10.4 (7.0 to 13.)	+0.1 (−1 9 to 2.2)	0.057[b]
COPD or asthma	6.6 (4 1 to 9 2)	9 5 (6 0 to 12 9)	+2 8 (0.3 to 5 3)	5 4 (3 6 to 7.3)	5.2 (3 2 to 7 3)	−0.2 (−1.4 to 1.1)	0.006[b]
Dementia	2.5 (1.4 to 3.5)	3 4 (2 0 to 4.9)	+0.9 (−0.2 to 2.1)	2.1 (1.4 to 2 7)	2.6 (1 2 to 4.0)	+0.5 (−0.8 to 1.9)	0.548[c]
Cancer	3.8 (2.5 to 5.1)	4 5 (3.3 to 5 7)	+0.7 (−0.7 to 2.2)	2.8 (1 9 to 3 7)	2.6 (1 4 to 3.8)	−0.2 (−1.4 to 1.0)	0.059[c]
Out-of-hours	4 8 (2.1 to 7.5)	3.3 (1.9 to 4.7)	−1.5 (−3.9 to 0.9)	3.7 (0 8 to 6 6)	5 8 (0.6 to 11 0)	+2.1 (−1.3 to 5.5)	0.217[b]
COPD or asthma	2.8 (1.2 to 4.4)	1.3 (0.5 to 2.0)	−1.5 (−3.0 to −0.03)	1.6 (−0.09 to 3.3)	2.3 (−0.09 to 4.6)	+0.7 (−0.9 to 2.2)	0.094[b]
Dementia	0.7 (−0 004 to 1.5)	0.3 (0.06 to 0.5)	−0 5 (−1 3 to 0 3)	0.5 (0.1 to 0.9)	0.9 (0.05 to 1.7)	+0.4 (−0.4 to 1.1)	0 172[b]
Cancer	1 2 (0.4 to 2.1)	1.8 (0.7 to 2.8)	+0.5 (−0.5 to 1.5)	1.6 (0 3 to 2 8)	2 6 (0.4 to 4.9)	+1.1 (−0.5 to 2.6)	0.673[b]

[a] Change over time in intervention and control groups (effect size)
[b] Mann-Whitney U test.
[c] Analysis of covariance

Table 3. Objective workload of general practitioners, expressed as the mean number of contacts with patients per week (95% confidence interval) per type of consultation during surgery hours (standardized by median number of days worked) and out-of-hours (standardized by mean number of shifts) before and after the introduction of the nurse practitioner

	Intervention group (n=20)			Control group (n=15)			
Patient contacts	**Before**	**After**	**Δ[a]**	**Before**	**After**	**Δ[a]**	**P value[b,c]**
Surgery hours	12.9 (9 0 to 16.8)	17.4 (12 4 to 22 4)	+4 5 (0.6 to 8 3)	10 3 (7 6 to 13.0)	10.4 (7 0 to 13.)	+0.1 (−1.9 to 2 2)	0.057[b]
Practice	6.4 (4.0 to 8 8)	9 5 (6 4 to 12 7)	+3.1 (0 9 to 5 4)	5 7 (3 8 to 7.6)	5.6 (3 2 to 8 0)	−0 09 (−1 6 to 1 4)	0.003[b]
Telephone	1.6 (0 7 to 2.4)	2.2 (1.3 to 3.2)	+0.7 (−0.4 to 1.7)	0 8 (0 4 to 1 3)	1.2 (0.6 to 1.8)	+0 3 (−0.1 to 0 8)	0 677[b]
Home visits	5.0 (3.3 to 6.6)	5.6 (3 6 to 7 6)	+0.7 (−1.0 to 2.4)	3 7 (2 6 to 4.8)	3.6 (2.0 to 5.3)	−0.09 (−1 2 to 1.0)	0.321[c]
Out-of-hours	4.8 (2.1 to 7 5)	3 3 (1 9 to 4 7)	−1 5 (−3 9 to 0 9)	3 7 (0.8 to 6.6)	5.8 (0.6 to 11.0)	+2 1 (−1.3 to 5.5)	0.217[b]
Practice	1.7 (0 5 to 3 0)	1.0 (0 4 to 1 6)	−0 8 (−1.9 to 0.4)	1.0 (−0.4 to 2.3)	2.0 (−0.2 to 4 2)	+1 0 (−0 7 to 2 8)	0.105[b]
Telephone	0.9 (−0 1 to 2.0)	0 3 (−0 03 to 0 6)	−0 6 (−1.7 to 0.5)	0.6 (−0.01 to 1.2)	0.5 (−0.1 to 1.1)	−0.1 (−0.5 to 2 0)	0.771[b]
Home visits	2 1 (1 1 to 3.2)	2 0 (1.0 to 3.1)	−0 1 (−1 3 to 1 0)	2 1 (0 8 to 3.5)	3 3 (0 5 to 6.1)	+1 2 (−1 0 to 3.4)	0.338[b]

[a] Change over time in intervention and control group (effect size).
[b] Mann-Whitney U test.
[c] Analysis of covariance

Discussion

The introduction of nurse practitioners to assist general practitioners in the management of patients with COPD or asthma, dementia, and cancer did not reduce the workload of the general practitioners. Measures of objective workload increased, at least in the short term. The number of contacts with general practitioners for COPD or asthma during surgery hours may have increased slightly because nurse practitioners discovered that some patients had unrecognized problems that demanded doctors' attention. This is particularly likely to occur when the care of patients with chronic diseases is first delegated to nurse practitioners and may diminish with time once the backlog of pre-existing problems is dealt with. Doctors and nurses may also require considerable time to develop the mutual understanding and trust needed to facilitate delegation of tasks. Longer term studies will be needed to establish whether workload is reduced beyond 18 months.

Possible benefit of introducing nurse practitioners

The increase in surgery contacts was partially offset by a small (non-significant) reduction in the number of contacts during evenings and weekends. It is possible that nurse practitioners improved the quality of care for patients during surgery hours, thus preventing calls out-of-hours. Further research is needed to evaluate this potential benefit.

General practitioners' subjective workload

Although we expected that nursing support would reduce the stress of a demanding job,[20] general practitioners reported no subjective benefits in terms of workload. This might be because general practitioners were already satisfied with three of the four aspects of work we investigated. Dissatisfaction with the fourth aspect - inappropriate demands from patients - was not readily susceptible to change as the general practitioner is the first point of contact for all patients and nurse practitioners assisted in the care of only three groups of patients. Interviews with general practitioners in the intervention group indicated, however, that doctors believed that nurses had lightened their burden of care for patients in the targeted groups.

Limitations of the study

We investigated the effect of adding nurse practitioners to the practice team on both objective and subjective aspects of general practitioners' workload in a controlled trial. The study was performed in only one region of the Netherlands, which may limit the generalizability of the findings. Several general practitioners were lost to follow up, which threatens the internal validity of the trial. Although not reaching significance, measures of objective workload were slightly higher among the general practitioners who withdrew.

The dropout rate was higher in the intervention group and may reflect uncertainty at that time about whether government policy would continue to support the employment of nurse practitioners. Although we have no reason to believe that these limitations appreciably biased the findings, the work would benefit from being replicated elsewhere.

Conflicting evidence

Although it is widely believed that adding nurses to the general practice team can reduce doctors' workload, the existing evidence is conflicting. Some have noted that nurses reduce general practitioners' workload.[8,21–24] Others have found no effect.[4,25,26] Differences in the effect might be explained by differences in nurses' degree of autonomy, level of training, and the conditions that they are asked to manage. Another explanation might be variation in the ratio of nurses to doctors.

Our findings are consistent with the view that nurses are often used as supplements, not substitutes, for general practitioner care. Gains for the efficiency of services can be achieved only if general practitioners give up providing the types of care they have delegated to nurses and instead invest their time in activities that only doctors can perform.[27] Further research is therefore needed into what factors facilitate delegation of tasks from nurses to doctors (for example, type of services, nurses' education, and training, etc.) and how doctors invest their time savings.

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Chapter 6

Patients with COPD and asthma are better managed by a nurse-doctor team: a randomized controlled trial

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Abstract

Background. In spite of clinical guidelines a substantial group of asthma and Chronic Obstructive Pulmonary Disease (COPD) patients do not receive optimal health care. It has been argued that adding nurses to the general practice team can improve respiratory care but evidence of this is lacking.

Aim. To study the effect of adding nurse practitioners to the general practice team on respiratory care provision, number of consultations, and patients' health. Subsequently, to find out whether nurses worked as doctors' substitutes or supplements.

Design of study. Cluster randomized controlled trial of adding nurse practitioners to general practice teams.

Setting. 32 general practices in the Netherlands.

Method. 995 questionnaires were posted to a random sample of asthma and COPD patients.

Results. The addition of nurse practitioners to general practice teams did not affect the number of patients receiving education and advice or the quality of this advice. However, it improved the appropriateness of lung function measurement of newly diagnosed asthma and COPD patients and known COPD patients. The nurse practitioners most often carried out lung function measurements (newly diagnosed 50%; COPD patients 75%). More patients were regularly monitored when a nurse was a member of the team: 69% versus 46%. Patients in the intervention group had significantly more contact with general practice teams than those in the control group, mean number of consultations 2.7 versus 2.0 respectively. With the exception of lung function measurement in COPD patients, nurse practitioners worked predominantly as general practitioners' supplements.

Conclusion. Adding nurse practitioners to the general practice teams improved the quality of care for chronic respiratory disease.

Introduction

Asthma and Chronic Obstructive Pulmonary Diseases (COPD) are two chronic diseases of the airways with a high prevalence[1,2] and a significant (socio-economic) impact on patients and their family.[3] The diseases are among the most common causes of death in Europe and North America.[4] These diseases are mainly diagnosed and treated in primary care. The optimal health care for patients with asthma and COPD is published in various guidelines and consensus reports.[5-8] In spite of these guidelines, there is still a substantial group of asthma and COPD patients who do not receive optimal health care according to these guidelines.[9-12] Deficiencies have been noted in relation to the measurement of reversibility in airflow obstruction, flu vaccination and health care advice. Regular follow-up may be performed in as few as 14% of patients.[11] The high workload of general practitioners may one reason for suboptimal care.[13] In particular patient education and self-management plans, the importance of which is emphasised in guidelines and consensus reports, are very time consuming.[14]

One way to facilitate guideline implementation is to add nurses to general practice teams.[15-18] Nurses may work either as substitutes or supplements for general practitioners. Nurses working as substitutes provide services which otherwise would be provided by doctors alone; they take over (part of) the care of doctors. Nurses working as supplements provide services which complement or extend those provided by doctors. General practices show considerable variation both within and between countries with respect to nurses' roles. In practice the revision of professional roles is often complex.[16] The impact of different nursing roles (i.e. substitution, supplementation or a combination) has been inadequately studied.

Uncontrolled, observational studies suggest that the involvement of nurses in asthma care improves the appropriateness of prescribing and reduces morbidity,[20-22] while at the same time, general practitioners' workload and patients' service use decreases.[20,23,24] The sole randomized controlled trial of nurse-run asthma clinics to be conducted was inconclusive as to the effectiveness of this model of care.[25] No research has yet been undertaken into the involvement of nurses in the care of COPD patients. Clear evidence of the effectiveness of the involvement of nurses in the management of respiratory diseases is therefore lacking.

We studied the impact of introducing nurse practitioners to general practices in the Southern region of the Netherlands on i) respiratory care, ii) number of consultations with general practice, and iii) patients' health. With regard to respiratory care, we looked particularly at those aspects of care which were to be delegated to the nurse practitioner, namely a) education and advice, b) measurement of airflow reversibility, and c) regular follow-up. Within the intervention group, we looked at the contribution of the nurse

practitioner and the general practitioner to respiratory care in order to determine whether nurses functioned as subsitutes or supplements for doctors.

Method

Design

We conducted a cluster randomized controlled study of the effect of adding a nurse practitioner to the general practice team on care provision for patients with asthma and COPD.[26] Twenty general practices, organized in four local groups of general practitioners (n=30), were assigned five trained nurse practitioners. The general practices (n=14) in the control group received no support from a nurse practitioner. We compared the respiratory care provided by a general practice team including a nurse practitioner (intervention group) with the respiratory care provided by a general practice team without a nurse practitioner (control group).

For the purpose of this study, we drew a random sample of patients with asthma and COPD from each practice and sent each patient a *self-administered questionnaire* to assess their respiratory care, number of consultations with the general practice team, and health. The questionnaire was sent 20 months after the nurse practitioners were introduced to the general practice (April 2000). Eligible patients were identified by general practitioners who selected asthma and COPD patients aged 18 years or older using the International Classification of Primary Care (ICPC) for COPD (R95) and asthma (R96) and prescription data from practice records or pharmacists. The number of patients so identified in each practice varied from 44 to 370 patients from which we drew a sample of 35 patients.

Intervention: nurse practitioners' role

The nurse practitioners were experienced community nurses who carried out a range of tasks according to agreed guidelines which were developed for this study. Before introduction in the general practice all nurses followed a training course which was specially developed for the project. The nurses performed diagnostic tests, such as lung function measurements, assessed patients' health and living conditions, performed (preventive) social visits, gave disease related education and advice, and coordinated the care of patients (liaison between general practice and other health services). Although patients were referred by the general practitioners the nurses had independent responsibility for care decisions within their scope of work. The nurse practitioners' role is described more fully elsewhere.[26,27]

Variables and measurements

The following outcomes were measured using a written patient questionnaire.

I) Respiratory care: we focussed on elements of the resiratory care in which the nurse practitioner could have a role.[6-8] We compared the care provided by the general practice team in the intervention group and in the control group. The following aspects of care were analysed:

a) Education and advice: the percentage of patients who received education and advice for 18 items grouped within six educational domains (see Table 3);[28] the quality of the education and advice expressed as mean (sd) scores for each of 18 items and overall mean (sd) score (3-point Likert scale where 1 = incomprehensible information and 3 = most comprehensible information); The overall mean education and advice score was calculated for those patients who evaluated 10 or more educational items. The percentage of patients receiving leaflets from the general practice team to support the oral information.

b) Smoking cessation: the percentage of (former) smokers who received advice from the general practice team to stop smoking; and the percentage of patients who actually stopped smoking;

c) Measurement of reversibility (FEV_1-measurement):
   i. *'newly diagnosed'* (i.e. diagnosis asthma or COPD in 1998 or later): the percentage of newly diagnosed asthma or COPD patients whose lung function was measured by the general practice team in the year of diagnosis or in the year after diagnosis; within this group the percentage of patients who received information from the general practice team about the reasons for measuring lung function; and the quality of this information expressed by a mean (sd) score (3-point Likert scale: see above)
   ii. *COPD patients*: the percentage of COPD patients whose lung function was measured by the general practice team in the previous year;[4,8] within this group the percentage of COPD patients who received information from the general practice team about the reasons for measuring lung function; and the quality of this information expressed by a mean (sd) score (3-point Likert scale: see above).

d) Patients' follow-up: the percentage of patients who was regularly followed-up by the general practice team; within this group the percentage of patients who received information from the general practice team about the importance of follow-up consultations; and the quality of this information expressed by a mean (sd) score (3-point Likert scale: see above). Subsequently, the percentage of patients who received a card with their next appointment date; and the percentage of patients who were contacted by the general practice team when they forgot to attend their follow-up appointment.

e) Nurses' role (intervention group only): in order to find out if the nurses worked as substitutes or as supplements we looked at which professional (doctor, nurse, or both) provided which elements of respiratory care (see above) to the patient. We calculated the percentage of patients receiving care from the general practitioner and the percentage of patients receiving care from the nurse practitioner. Among those who received care from the nurse practitioner, we calculated the percentage of patients who also received care from the general practitioner.

II) Number of consultations: the mean (sd) number of consultations with the general practice team in the six months prior to completion of the questionnaire. Additionally, within the intervention group, we looked at the mean (sd) number of consultations with the general practitioner and with the nurse practitioner.

III) Patients' health: the mean (sd) self-reported general health score (5-point Likert scale where 1 = excellent and 5 = very poor) and the mean (sd) self-reported general health score compared to the previous year (5-point Likert scale where 1 = much worse and 5 = much better).

The following patient characteristics were also gathered: gender, age, education (4 categories: low, middle, high, other), living condition (5 categories: single, with partner with children, with partner without children, without partner with children, other), occupation (yes/no), diagnosis (4 categories: asthma, COPD, mixed, other), number of years since diagnosis and co-morbidity. Gender, age and diagnosis of the non-respondents were provided by the general practitioners. They were also asked to give possible reasons for the non-response.

Power calculation

The primary effect parameters were the difference between the two groups in proportion of patients receiving education and advice from the general practice team and the proportion of patients who was regularly followed-up by the general practice team. For education and advice a difference of 15% was regarded as clinically relevant (improvement 50% to 65%). For regular follow-up a difference of 15% was anticipated (14% to 29%). To detect these differences between intervention and control group we required respectively 31 practices and 21 practices including 14 patients per practice (power =0.80; alpha =0.05, intra-cluster correlation=0.02).[29] To allow for drop-out, all practices (n=34) were included. To allow for non-response, wrong addressess and patients 'exclusively' treated by medical specialists, we asked general practices to send questionnaires to 35 patients.

Analysis

In the analysis we only included patients who indicated that the general practice team (i.e. general practitioner and/or nurse practitioner) was involved in their respiratory care. In some cases the medical specialist was also involved. Patients who received respiratory care exclusively from medical specialists were excluded.

The primary outcomes were the proportion of patients who received education and advice, the proportion of patients regularly follow-up and also the number of consultations with the general practice team and patients' health. All other outcomes were secondary outcome measures. Because of the hierarchical structure of our study (patient nested within practice) we performed multilevel (mixed model) regression analyses. To assess the significance of difference in the percentages between the intervention group and control group we used multilevel logistic regression models. For continuous outcomes we used multilevel linear regression analysis to assess the significance of the difference in mean (sd) scores between intervention group and control group. A two-sided p-value below 0.05 was considered statistically significant (SAS v8.2 for windows). Descriptive statistics were used to describe patients characteristics and secondary outcome measures (SPSS 12.0.1). For secondary outcome measures multilevel regression analysis was only performed when sufficient number of patients could be included. All analyses were corrected for the involvement of the medical specialist (possible confounder).

Descriptive statistics were used to assess whether the nurses worked as substitutes or as supplements. The expectation was that general practitioners would delegate the above reported elements of respiratory care to the nurse practitioners, meaning that nurses would work predomantly as doctors' substitutes. We operationalized this as '*less then 20% of the patients would receive the same type of respiratory care from both the general practitioner and the nurse practitioner*'. The nurse was also expected to be the principal provider of these aspects of care to the majority of patients. This was operationalized as '*the nurse practitioner is involved in the care of at least 75% of the patients*'. If these criteria for substitution did not apply, the nurse practitioner was said to work as a doctors' supplement (i.e. offer a wider range of services than previous available).

Results

Study population

Figure 1 displays the patient flow. After excluding ineligible patients (e.g. moved, death, too young, etc.) 995 questionnaires were sent. In total 602 patients returned the questionnaire (61%). From the 433 patients who were included in the analysis 284 exclusively received care from the general practice team and the remainder (n=149) received care from both the general practice team and the medical specialist.

Figure 1. **Trial flow of COPD/asthma patients through trial**

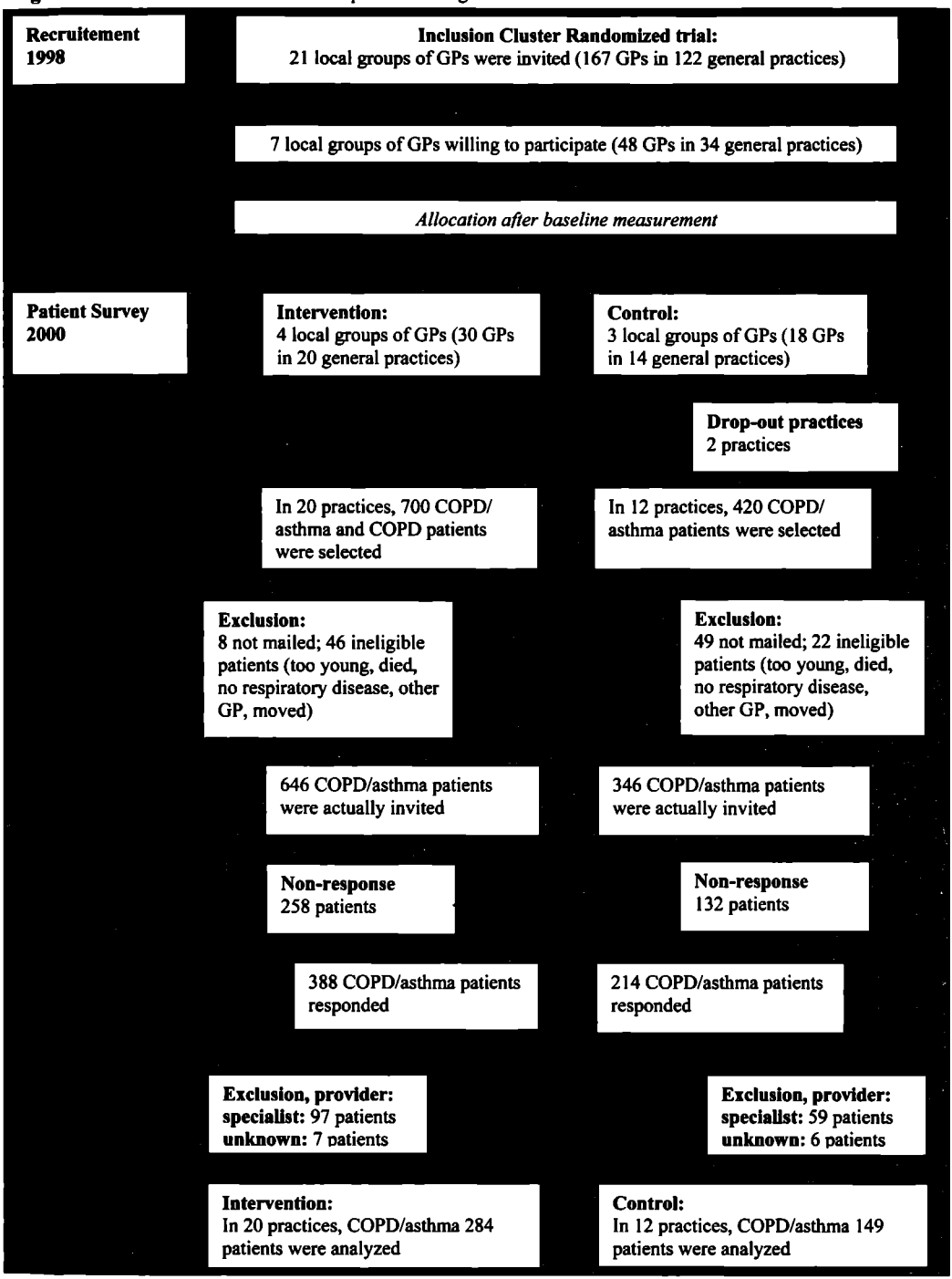

Table 1 summarizes the characteristics of patients included in the analysis. The intervention and control goup were comparable in most respects. However, the intervention group had significantly more females and patients with co-morbid disease.

Twenty-five general practices provided information on the age, gender and diagnosis of 282 non-respondents. No information on non-respondents was available from seven practices. As compared with respondents included in the analysis, non-respondents were more likely to be diagnosed with asthma and less likely to be diagnosed with COPD (respondent vs non-respondent, 27% vs 51% (asthma); 73% vs 49% (COPD) (n=601 patients).

Table 1. Characteristics of the study population (n=433)

Patient characteristics	Intervention group (n=284)	Control group (n=149)	χ^2-, F- and P-value
Age (mean years/ SD)	53 0 (17.41)	52.5 (16.80)	F=0.089; p=0.766
Gender (% male)	42.0	55.7	χ^2=7 311; p=0 007
Education (%):			χ^2=2 437; p=0 487
• Low	41.4	39 9	
• Middle	27.3	29.7	
• High	21.2	24 3	
• Other	10.1	6 1	
Living condition (%):			χ^2=0.827; p=0.935
• Single	19.9	17 6	
• With partner, without children	40.6	41.9	
• With partner, with children	31.7	32.4	
• Without partner, with children	3.6	2 7	
• Other	4.3	5.4	
Occupation (Yes %):	47.5	50.3	χ^2=0.307; p=0 580
Diagnosis			χ^2=2 199; p=0 532
• Asthma	21.2	23 6	
• COPD	62 2	56 1	
• Mixed (Astma and COPD)	10.8	14 9	
• Other	5 8	5 4	
Years diagnosis (mean/SD)	19 5 (16.19)	18 4 (15.74)	F=2.199; p=0.526
Co-morbidity (% yes)	53.5	42 3	χ^2=4 948, p=0.026
Smokers (%)			χ^2=2.069, p=0 355
• Non-smokers	27 9	31.5	
• Current	38.5	31 5	
• Previous	33.6	36.9	

Respiratory care

Table 2 summarizes the different elements of respiratory care received by patients (primary outcome measures). The general practice team educated 78.3% of the patients (n=324) with the proportion being significantly higher in the intervention group than the control group. A small majority of the patients (57%) received information exclusively from the general practice team.

Table 2. Overview of differences in primary outcomes: education and advice and follow-up by the general practice team (GPT), number of consultations with GPT, and patients' health expressed by percentage (n/N) or mean (sd) (n)

Respiratory care	Intervention group (n=284)	Control group (n=149)	OR (95% CI); F-value; p-value
Education and advice			
• Education and advice from GPT (n=414)	82.2 (221/269)	71.0 (103/145)	OR=1.80; (0.97 to 3.33); p=0.06
Patients' follow-up			
• Follow-up consultation offered by GPT (n=242)	69.3 (113/163)	45.6 (36/79)	OR=2.24 (1 01 to 4.98); p=0.049
Service use (n=426)			
• Number of consultations GPT (mean; (sd))	2.7 (3.04); (n=277)	2.0 (2.25),(n=149)	F=7 09 p=0 008
• Number of consultations with GP only (mean; (sd))	2.3 (2.82); (n=257)	2.0 (2 25), (n=149)	F=0.95; p=0 33
Patients ' health (n=433)			
• Current health score (mean, (sd))[b]	3 5 (0 76) (n=284)	3.5 (0.84) (n=149)	F=0.09; p=0.76
• Improvement health score (mean; (sd))[c]	3.0 (0 87) (n=284)	2.8 (0.86) (n=149)	F=3.74; p=0.05

[a] OR=Odds Ratio, [b] Higher score is poorer health· 1 excellent health to 5 very poor health; [c] Higher score is better health compared to one year ago: 1 much worse to 5 much better.

Tables 3 and 4 summarize secondary outcome measures. The education and advice given by the general practice team was for the majority of the patients comprehensible (Table 3).

Table 3. Mean (sd) scores for education and advice by the general practice team (n=324)[a]

	Intervention group (n=221)	Control group (n=103)	F- and p-value
Overall education and advice score[b]	***2.2 (0.54)***	***2.1 (0.47)***	***F=1.05; p=0.3074***
General information about respiratory diseases			
• Basic characteristics of the disease	2 3 (0.65)	2.3 (0.66)	F=0.01; p=0.93
• Possible causes of the disease	2 0 (0.79)	2 0 (0.79)	F=0.02; p=0.90
• Mechanism of shortness of breath	2 2 (0.76)	2.2 (0.65)	F=1.03; p=0.31
• Prognosis of the disease	2 0 (0.77)	1.8 (0.77)	F=2 40; p=0.12
• Goals of disease management	2.3 (0.65)	2.2 (0.65)	F=1 10, p=0.30
Information about hyperreactivity and allergies			
• Hyperreactivity and personal triggers	2 1 (0.76)	2.1 (0.69)	F=0.19; p=0.66
• Nature of allergy	2 3 (0.70)	2.3 (0.67)	F=0.39; p=0.53
• Cause of allergy	1 9 (0.81)	1.8 (0.82)	F=0.82; p=0.36
• Prevention of allergy	2.1 (0.76)	2.0 (0.71)	F=0 38, p=0.54
Information about tests and investigations			
• Information about intracutaneous allergy test	2 2 (0.75)	2.2 (0.69)	F=0.00; p=0.99
Information about drugs and how to use these			
• Effects of short-term bronchodilators	2.2 (0.75)	2.1 (0.72)	F=0.79; p=0.38
• Effects of long-acting bronchodilators	2.1 (0.78)	2 1 (0.69)	F=0.08; p=0.78
• Effects of inhaled steriods	2.1 (0.79)	1 9 (0.77)	F=3.39; p=0.07
• Side effects of inhaled steriods	1.8 (0.80)	1 7 (0.78)	F=0.61; p=0.44
• Importance of proper inhalation technique	2 3 (0.70)	2.3 (0.69)	F=0.19; p=0.66
Information about non-medical treatment and lifestyle			
• Sanitation at home	2.3 (0.73)	2.2 (0.72)	F=3 00; p=0.08
• Effects of (passive) smoking	2.5 (0.63)	2 4 (0.67)	F=0.07; p=0.79
Other information			
• Importance of influenza vaccination	2 4 (0.74)	2.2 (0.80)	F=1 78, p=0 18

[a] Higher score means that the patient understood the education and advice very well; measured with 3-point Likertscale where 1 = incomprehensible; 2 =comprehensible; 3 = most comprehensible. [b] Cronbach's alpha = 0.941.

Two thirds of smokers received stop smoking advice. Within this group, the majority were given this advice by the general practice team (85% intervention versus 79% control). More patients in the control group stopped smoking after getting this advice, but the difference in proportion with the intervention group was not significant (Odds Ratio 0.68; p=0.30).

The intervention group was more likely to receive lung function measurements in line with guideline recommendations both for newly diagnosed asthma and COPD patients and for known COPD patients (respectively, 79% (intervention) vs 42% (control); 58% (intervention) vs 19% (control) (Table 4).

Approximately 50% of patients were regularly monitored, but the proportion offered a follow-up appointment was significantly higher in the intervention than the control group (Table 4). Patients in the intervention group were more likely to be given an appointment card with the date of their next appointment (71%) and reminded when they forgot to attend the follow-up appointment (89%) compared to control group (respectively, 50% and 71%).

Table 4. Overview of differences in secondary outcomes: expressed by percentage (n/N) or mean (sd) (n).

Aspects of respiratory care by the General Practice Team	Intervention group (n=284)	Control group (n=149)
Education and advice		
• Leaflets (n=148)[a]	76 4 (81/106)	85 7 (36/42)
Smokers (n=306)		
• Stop smoking advice (n=191)[a]	84.5 (109/129)	79 0 (49/62)
• Actually stop smoking after advice (n=158)[a]	29.4 (32/109)	38 8 (19/49)
Measurement of reversibility		
Newly diagnosed patients (n=40)		
• Lungfunction measurement (diagnosis) (n=31)	78.9 (15/19)	41 7 (5/12)
• Information reasons lung function measurement (n=20)	100 (15/15)	100 (5/5)
• Clarity of information (mean, (sd))	2.5 (0.52), (n=15)	2 8 (0.45); (n=5)
COPD patients (n=256)		
• Lungfunction measurement once a year (n=106)	58.1 (43/74)	18 8 (6/32)
• Information reasons lung function measurement (n=46)	97.5 (39/40)	83 3 (5/6)
• Clarity of information (mean; (sd))	2.5 (0.51), (n=39)	2 6 (0 55); (n=5)
Patients' follow-up		
• Information reasons follow-up (n=131)	96.9 (95/98)	93.9 (31/33)
• Clarity of information (mean; (sd))	3.5 (0.56); (n=93)	2 5 (0.57); (n=31)
• Appointment card (n=67)	70.6 (36/51)	50.0 (8/16)
• Reminder fogotten appointment (n=61)	89.4 (42/47)	71.4 (10/14)

[a] Multi level logistic regression analyis: no significant difference between groups.

Table 5 summarizes which aspects of care were provided by nurse practitioners and which by general practitioners (intervention group). The general practitioner was primarily responsible for patient education and advice. General practitioners gave stop smoking advice to the majority of smokers, whereas nurse practitioner gave this advice to only a

quarter of the smokers. Only one third of the smokers quit smoking after getting this advice, but the proportion was higher when advice was provided by general practitioners.

Table 5. Overview of the involvement of the nurse practitioner and the general practitioner with regard to respiratory care and service use expressed by percentage (n/N) or mean (sd) (n). (intervention group only; n=284)

Aspects of respiratory care by General Practice Team	General Practitioner	Nurse practitioner
Education and advice (n=221)		
• Education and advice	89 1 (197/221)	24 9 (55/221)
• Leaflets	90 3 (65/72)	88 5 (23/26)
Smokers (n=109)		
• Stop smoking advice	94 5 (103/109)	25 7 (28/109)
• Actually stop smoking after advice	31 1 (32/103)	7 1 (2/28)
Measurement of reversibility		
Newly diagnosed patients (n=15)		
• Lungfunction measurement after diagnosis	60 0 (9/15)	53 3 (8/15)
• Information reasons lung function measurement	77 8% (7/9)	87 5% (7/8)
COPD patients (n=43)		
• Lungfunction measurement once a year	30.2 (13/43)	76 7 (33/43)
• Information reasons lung function measurement	83 3 (10/12)	96 8 (30/31)
Patients' follow-up (n=113)		
• Follow-up consultation offered	63 7 (72/113)	53 1 (60/113)
• Information reasons follow-up	91 5 (54/59)	100 (53/53)
• Appointment card	43 8 (14/32)	81 8 (27/33)
• Reminder fogotten appointment	41 9 (13/31)	77 1 (27/35)

The nurse practitioners had a more prominent role in lung function measurement. They performed lung function measurements in 50% of newly diagnosed patients and 75% of COPD patients. Both nurse practitioners and general practitioners had a role in the monitoring of patients. The general practitioners saw slightly more patients for follow-up consultations than did nurse practitioners. Compared to general practitioners, nurse practitioners were more likely to give patients an appointment card and to contact patients who forgot to attend.

Some aspects of the care provided by nurse practitioners were duplicated by general practitioners. These percentages varied from 9.1% for lung function measurement of COPD patients to 78.6% for stop smoking advice. With the exception of lung function measurement in COPD patients, nurse practitioners worked for the greater part as doctors' supplements.

Number of consultations

As compared with the control group patients in the intervention group had significantly more consultations in the past six months with the general practice team (2.7 (sd 3.04) vs 2.0 (sd 2.25); F=7.09 (df1); p=0.0081) (Table 2). The excess of consultations in the intervention group is attributable to visits to the nurse practitioner. Patients who indicated

that the nurse practitioner was involved in their care had on average 1.5 (sd 2.24; n=73) consultations with the nurse practitioner. If we look soley at consultations with general practitioners, we see no difference between the two groups in the number of consultations.

Patients' health

Approximately half of the patients thought they were in good health. They scored on average 3.5 (sd 0.79). Compared to the previous year the majority evaluated their health as being the same or better. Although not significant, the health of patients in the intervention group improved slightly more compared to the health of patients in the control group (Table 2).

Discussion

Summary of main findings

We conducted a small scale project to investigate the impact on respiratory care of adding a nurse practitioner to the general practice team. Although deficiencies in respiratory care remained, teams which incorporated nurses saw improvements with regard to regular monitoring of patients with asthma and COPD, and lung function testing in newly diagnosed asthma and COPD patients and known COPD patients was more in line with guidelines.[4,6-8] Although not statistically significant, patients in the intervention group were more likely to report improved health in the previous year. These gains must be set against the higher consultation rate among patients attending practices with a nurse practitioner in the team. The findings showed that nurse practioners worked predominantly as supplements, not as substitutes, for general practitioners who still played a prominent role in patient education. The nurse practitioners supplemented doctors' care through regular measurement of lung function and follow-up of patients. In this way, nurse practitioners worked in partnership with general practitioners to improve patient care.

Strenghts and limitations of the study

We conducted a survey amongst a random sample of asthma and COPD patients in general practices which had been randomly allocated a nurse practitioner to assist with respiratory care. In so doing, we were able to identify possible differences in care delivery attributable to nurses. Patient casemix may partly explain the observed differences between groups, but this is not anticipated as according to guidelines[6-8] the respiratory care for both asthma and COPD patients is comparable. Another factor that might explain the relatively small effects is that only about one third of the patients actually saw, at least once, a nurse practitioner during the intervention period.

The measurement was conducted 20 months after the introduction of the nurse practitioner, which may have been too short to measure the effects on respiratory care Previous research showed that the general practice team needed a habituation period before nurses were optimally deployed [27 30] Further research over a longer time period is needed to investigate if, in the long run, the addition of nurse practitioners to the general practice team optimizes health care for patients with asthma and COPD

Comparison with existing literature

In our study we found that smoking cessation advice delivered by nurses was less effective than that delivered by doctors It may be that patients viewed general practitioners as more authoritative than nurse practitioners Positive effects of smoking cessation advice and counseling by nurses was found in a systematic review [31] Also Holt[32] found that nurse practitioners achieved a high quit rate The relatively small numbers who quit smoking in our study might be due to the fact that nurse did not implement a specific smoking cessation intervention Advice to stop smoking was just a part of the regular respiratory care for asthma and COPD patients Nurses had added responsibility for other clinical tasks which has been found to weaken the impact of smoking interventions [31]

In our study nurse practitioners took responsibility for the lung function measurement of a majority of the newly diagnosed asthma and COPD patients and known COPD patients This finding is consistent with others [33] We did not assess the quality of lung function measurement, but appropriate measurement is obviously important to ensure accurate diagnosis and implementation of correct treatment [33 34] Previous research has shown that nurses are comparable to general practitioners, when both are adequately trained [34 36] Continuous education of both nurses and doctors with regard to spirometry is a necessity for successful spirometry in primary care

Clinical guidelines point to the importance of a regular monitoring system for patients with chronic respiratory diseases, yet in our study, a minority of patients with asthma or COPD were regularly followed up While the nurse practitioners improved monitoring, proactive care was not much stimulated This might explain why we found only limited effects compared to others in which more intensive proactive self-management, disease management or intergrated care programmes were implemented [30 37 40] These studies showed improved patient outcomes,[37 41] less hospital admissions[17 40] and cost-savings [37 38] In contrast, a review on effectiveness of innovation in nurse-led chronic disease management for COPD patients concluded that there is little evidence to support the widespread implementation of nurse-led chronic disease management programs [42]

Although some studies have been able to show a reduction in number of consultations with general practitioners[20 23 24] our findings are in line with the results of Son et al who

found no reductions.[30] It may be that on introduction of a nurse practitioner to the general practice team, attention is first given to dealing with the backlog in care delivery and only later to reducing the workload of general practitioners.[26,30] It remains unclear which aspects of care are best provided by nurses and which by doctors in order to maximize the quality of care, patient health outcomes and service cost-effectiveness.

Implications for clinical practice

Respiratoy care for patients with asthma and COPD can be improved by adding a nurse practitioner to the general practice team. The nurse practitioner is able to take over some of the tasks of the general practitioners without negatively affecting the quality of care. The nurse practitioner's work is complementory to that of the general practitioner. By so doing, some of the deficiencies in care - notably the regular follow up of patients and monitoring of lung function - were decreased. Nurse-led care services therefore have the potential to improve patients outcomes.

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Chapter 7

Patients' evaluation of general practitioners and of nurse practitioners

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Submitted.

Abstract

Aim and objectives. To assess patients' views on the care provided by nurse practitioners compared to that provided by general practitioners and to determine factors influencing these views.

Background. Many countries have sought to shift aspects of primary care provision from doctors to nurses. It is unclear how patients view these skill mix changes.

Design. Cross-sectional survey.

Method. 235 patients who received care from both nurse and doctor were sent a self-administered questionnaire. The main outcome measures were patient preferences, satisfaction with the nurses and doctors, and factors influencing patients' preference and satisfaction.

Results. Patients preferred the doctor for medical aspects of care, whereas for educational and routine aspects of care half of the patients preferred the nurse or had no preference for either the nurse or doctor. Patients were generally very satisfied with both nurse and doctor. Patients were significantly more satisfied with the nurse for those aspects of care related to the support provided to patients and their families, and to the time made available to patients. However, variations in preference and satisfaction were mostly attributable to variation in individual patient characteristics, not doctor, nurse or practice characteristics.

Conclusion. Patient preference for nurse or doctor and patient satisfaction both vary with the type of care required and reflect usual work demarcations between nurses and doctors. In general, patients are very satisfied with the care they receive.

Relevance to clinical practice. In many countries, different aspects of primary care provision have shifted from doctors to nurses. Our study suggests that these skill mix changes meet the needs of patients and that patients are very satisfied with the care they receive. However, to implement skill mix change in general practice it is important to consider usual work demarcations between nurses and doctors.

Introduction

Background

Many countries have sought to shift aspects of primary care provision from doctors to nurses in order to reduce the demand for doctors, fill previously unmet health needs, improve healthcare efficiency, and maintain quality of care This shift is likely to have consequences for the patient who is no longer exclusively seen and treated by a general practitioner There is little research available about how patients perceive these changes in skill mix

Patients' perceptions

Previous reviews of research into skill mix changes in primary care have suggested that patients tend to be more satisfied with nurse-led care than with doctor-led care [1-4] High satisfaction with nurse-led care does not, however, mean that patients inevitably prefer nurses to doctors Patient preferences in most studies are mixed [2,3] The reason for this is unclear and may relate to a number of factors

It is known that satisfaction with general practitioners is determined by patient characteristics, such as age,[5,11] gender,[7,8,11] education,[10,11] economic status,[5,11] ethnic background,[5,6] nature of the presenting problem[12] and health status[10,11] Factors related to the general practitioner or general practice may also influence patients' satisfaction, such as personal style and skills,[5,13,14] age,[7,8], gender,[8] practice size,[7,8] and personal list system[7,8] It is also argued that differences between doctors and nurses such as gender,[13] social status,[13] and frequency and length of consultations,[8,9,15] type of care provision, and interpersonal skills of practitioners[12] may influence patients' evaluations of care and preference It is, however, unclear if satisfaction with nurse-led care is determined by the same factors determining satisfaction with doctor-led care, and if these factors explain patients' preference for a specific type of practitioner

Assessment of patients' preferences and satisfaction allows the general practice team to investigate the extent to which their service meets the needs of their patients [16] Identifying sources of dislikes and dissatisfaction enables the general practices team to improve certain aspects of care [17] A better understanding of determinants influencing patients' preferences and satisfaction can help to improve the services provided [11,18]

Nurse practitioners' role

Nurse practitioners were first introduced to general practices in the Netherlands around the mid 1990's [19,20] The study reported in this paper was one of the first small scale quality improvement projects in which the effects on patient care of introducing nurse practitioners in general practice were evaluated [21] The project was initiated and funded by the Local

Association of General Practitioners and the Local Community Nursing Authorities. Measurement of effects was important to support claims for future funding of nurse practitioners from the local health care insurance companies. The project was located in a region in the Southern part of the Nethelands.

All local groups of general practitioners (n=21), comprising 167 general practitioners, were invited to participate. Regional policy stated that each local group should ideally have one full time nurse practitioner.[22] Money was available to provide the general practitioners of four local groups with a full-time nurse practitioner. The nurse practitioners, all of whom had at least two years nursing experience and a bachelor degree, were selected by the Local Community Nursing Authorities. Community nurses were invited to apply for these new jobs. Five nurses were employed as nurse practitioners; two shared one job (each 20 hours per week), the other three each worked 32 to 36 hours per week. After a brief training course the nurses started work as nurse practitioners. The nurse practitioners carried out a range of tasks according to agreed guidelines which were developed for this study. These guidelines were based on evidence based guidelines for general practitioners developed by the Dutch College of General Practitioners (NHG) in which recommendations are given for diagnostics, non-drug treatment, drug treatment and referral. The nurses performed diagnostic tests, such as lung function measurements, assessed patients' health and living conditions, performed (preventive) social visits, and coordinated the care of patients (liaison between general practice and other health services). Although patients were referred by the general practitioners (n=30) the nurses had independent responsibility for care decisions within their scope of work. They worked with, rather than for, the general practitioners. The nurse practitioner's role is described more fully elsewhere.[21,23]

Purpose

The aim of the study was to explore: 1) patients' preferences for a nurse practitioner or a general practitioner; 2) patient satisfaction with nurse-led care compared to doctor-led care; and 3) factors influencing patients' preferences and satisfaction.

Method

Design

We conducted a cross-sectional survey with a self-administered questionnaire to measure patients' preferences and satisfaction with nurse practitioners' care and general practitioners' care, and their determinants. Twenty months (April 2000) after the introduction of nurse practitioners in the general practices (n=20) a questionnaire was sent to a random sample of patients. The sample was taken from the cohort of patients (n=1793)

who were referred to the nurse practitioners, to ensure that the patients had actual experience with the care provided by nurse practitioners. As nurses had to grow into their new roles, patients referred in the initial year of the study were excluded from the study. The sample of patients was drawn from those patients (n=770) who were later referred to the nurse practitioner, between September 1999 and February 2000.[21] Patients were stratified by nurse practitioner and by type of disease. For each nurse practitioner samples of patients with asthma or Chronic Obstructive Pulmonary Disease (COPD), dementia, cancer or other diseases were randomly selected by computer. As the majority of referred patients had asthma or COPD (n=358) or other diagnoses (n=344), we were able to include 20 patients in each of these two groups per nurse practitioner. Only a few referrals concerned patients with dementia or cancer, so for each of these groups one to five patients of each type per nurse practitioner were selected. In total 235 patients were selected and received a questionnaire. For patients with dementia the questionnaire was administered to the caregiver (partner, son or daughter). All patients had received care from the general practitioner as well as the nurse practitioner.

Data collection

The patient questionnaire consisted of three domains: a) preference; b) satisfaction; and c) patient characteristics (determinants). The comprehensibility of the questionnaire was piloted in a sample of 20 patients who were not included in the final sample of patients. These patients reported no difficulties in answering the questions and showed satisfactory variation in preferences and satisfaction scores. The content of these three domains are elaborated below.

Determinants at the level of the general practitioner, general practice and nurse practitioner were measured by self-reported questionnaire administered to professionals.

Preference

To measure patients' preferences we asked the patient which practitioner s/he preferred for eight different aspects of care: (1) medical care and treatment, (2) discussing physical complaints, (3) discussing emotional problems, (4) education about disease and prognosis, (5) education about prescribed medication, (6) information and advice on how to deal with the disease, (7) referral to other health care providers or services, and (8) regular follow-up of the disease. Response categories included: 'no preference'; 'general practitioner'; 'nurse practitioner'.

As no validated questionnaire existed to measure patients' preference for a particular type of professional we developed and tested our own instrument. The eight aspects of care were derived from the guidelines for nurse practitioners and general practitioners, and

included aspects of care both professionals could provide. This was confirmed by the participating general practitioners and nurse practitioners (face-validity). The reliability of this domain, expressed by Chronbach's alpha, was 0.784 showing that the items all measured patients' preferences (internally consistency). A Chronbach's alpha of 0.70 or more is acceptable in correlational reseach.[24] The reliability would not have been improved by deleting one or more of the eight aspects of primary care. Other psychometric testing of this domain confirmed validity and reliability: a) item-respons rates varied from 82% to 96%; and b) there was sufficient variation in preferences across the eight items.

Satisfaction

We used the validated and highly reliable "Chronically ill patients Evaluate general Practice (CEP)" questionnaire to measure patients' satisfaction with different aspects of primary care.[25] Six subscales measured satisfaction with (1) continuity of care (1 item), (2) cooperation (1 item), (3) medical care (2 items), (4) relationships and communication (2 items), (5) information and advice (2 items), and (6) support (6 items). Each item was rated on a 6-point Likert scale, ranging from 'poor' to 'excellent'. Patients could additionally score an item as 'not relevant' or 'not applicable'. As the questionnaire has only been validated for doctor-led care, we tested its psychometric properties when applied to nurse-led care. We found a high Cronbach's alpha (0.911) for satisfaction with nurse practitioners. Other psychometric characteristics were also satisfactory; item-response rates varied from 68% to 97% (with exception of two items where item-response was approximately 50%) and there was sufficient variation across response categories.

Determinants

The following groups of factors were investigated with self-administered questionnaires: a) patient characteristics (age, gender, eduction, diagnosis, self-reported health, frequency of visits to the general practitioner in the last six months, and frequency of visits to the nurse practitioner in the last six months), and b) general practitioner/general practice characteristics (gender, age, years working as general practitioner, full-time equivalent, job satisfaction, type of practice and number of patients in practice). Although only a small number of nurses were included in our study, we also took some nurse characteristics into account (age, years of experience following bachelor degree in nursing, full-time equivalent, and job satisfaction).

Data analysis

The unit of analysis was the patient. Descriptive statistics were used to describe characteristics of the study population, patients' preferences, and patients' satisfaction with the nurse practitioner and with the general practitioner. Characteristics of the general practitioners, the practice they worked in, and characteristics of the nurse practitioners were similarly analysed with descriptive statistics (SPSS 12.0.1).

For determinant analysis we constructed an overall preference score by counting the number of care aspects for which patients preferred a nurse practitioner or had no preference for either the general practitioner or the nurse practitioner (8 items, interval range 0 to 8). Patients with missing data on any of the eight items were excluded. A higher score represents a pronounced preference for the nurse practitioner or no preference for either the nurse practitioner or the general practitioner, whereas a lower score signifies a preference for the general practitioner.

To explore what factors influenced patients' satisfaction we constructed an overall satisfaction score. A mean overall satisfaction score was constructed by calculating the mean satisfaction score across 13 CEP-items separately for nurses (Cronbach's α=0.91) and for doctors (Cronbach's α=0.94). The mean satisfaction score was calculated by first summing the scores on the separate items, and then dividing this total by the number of questions answered. Only patients who answered at least 7 out of 13 questions were included.

To assess the significance of the difference in mean satisfaction scores between nurse practitioners and general practitioners we used mixed model repeated measures analysis (SAS v8.2 for windows). This analysis enabled us to correct for within-subject correlations as the same patient concurrently evaluated care provided by the nurse practitioner as well as by the general practitioner and for the nested structure of our data (i.e. patients nested within general practices).[26] A two-sided $p \leq 0.05$ was considered statistically significant.

Mixed model multivariate linear regresion models were used to investigate predictors of preference and satisfaction. The three dependent variables in the regression analysis were 'overall preference score', 'overall satisfaction score for nurse practitioners' and 'overall satisfaction score for general practitioners'. Associations with all independent variables were first examined with univariate multilevel linear analysis. Only those variables which were associated with the dependent variables - two-sided p-value ≤ 0.15 - were included in the multivariate analysis.

Results

Study population

Patient characteristics

Of the 235 patients who received a questionnaire 117 returned it, giving a response rate of 50%. Sixteen patients were excluded from the analysis because, in their own opinion, they were not able to evaluate the nurse practitioner's care.

The characteristics of the study population are described in table 1. Respondents were on average 63.9 (sd 15.8) years and 60% were female. Patients had an average 4.2 (sd 6.3) contacts with the general practitioner in the last six months compared to 3.6 (sd 4.5) contacts with the nurse practitioner. The patients evaluated their health as good to very good, mean score 2.5 (sd 0.8), on a 5-point Likert scale ranging from excellent (1) to poor (5).

There were no significant differences in demographic characteristics between the responders and non-responders with regard to gender, age and diagnosis. Patients with COPD or asthma were slightly more likely to have responded compared to other patient groups; 55% of the patients with COPD or asthma responded compared to 43% to 47% patients with dementia, cancer or other diagnoses. The respondents resembled the total cohort of patients referred to the nurse practitioners with regard to gender but were slightly older.

Provider characteristics

Characteristics of both general practitioners and nurse practitioners are shown in table 1. The project included 30 general practitioners, who worked in 20 general practices. Half of the practices were single handed and the average number of patients per practice was 3538 (sd 1186). The majority of the general practitioners were male (80%), 46 (sd 6.5) years old, and were very experienced (mean 17.4 (sd 6.8) years working). The mean full-time equivalent (fte) was 0.87 (0.2) fte. The project included five female nurse practitioners, 42.9 (sd 5.6) years old, who had worked as a nurse for relatively long periods (mean 14.6 (2.6) years post nursing degree).

Table 1. Study population: characteristics of patient (including non-respondents and sample cohort), and characteristics of general practitioners, general practices and nurse practitioners

	Respondents[a]	Non-respondents	Sample cohort [21]
Patient characteristics	**n=117**	**n=118**	**n=1793**
Gender (male)	40.2%	35.9%	40 4%
Age			
< 45 years	12 8%	19 7%	26.3%
45 - 54 years	13.7%	11.1%	11.7%
55 – 64 years	23 9%	15 4%	12.8%
65 – 74 years	16.2%	15.4%	17.6%
75 - 84 years	29 9%	25.6%	20.4%
≥ 85 years	3.4%	12.8%	11.2%
Mean (sd)	63.5 (15.99)	63 9 (19 53)	57.8 (24.85)
Disease			
COPD/asthma	46.2 %	39.0 %	53.5%
Dementia	7.7 %	10.2 %	6 7%
Cancer	6.0 %	6.8 %	4.8%
Other	40.2 %	44 1%	35.0%
Education			
Low	37%	-	-
Medium	51%	-	-
High	12%	-	-
Self-reported health (mean; (sd))	2.5 (0.82)	-	-
Number of contacts GP last 6 months (mean; (sd))	4.2 (6.3)	-	-
Number of contacts NP last 6 months (mean; (sd))	3.6 (4.5)	-	-
GP characteristics[b]	**n=30**		
Age (mean, (sd))	46.4 (6 50)		
Gender (male)	80%		
Years working as GP (mean; (sd))	17 4 (6.7)		
Full-time equivalent (mean; (sd))	0.87 (0.2)		
Job satisfaction (mean; (sd))	2 8 (0.4)		
General practice characteristics	**n=20**		
Type of practice (single handed)	52%		
Number of listed patients (mean; (sd))	3538 (1186)		
NP characteristics[c]	**n=5**		
Age (mean, (sd))	42 9 (5.6)		
Gender (male)	0%		
Years working as nurse (mean; (sd))	14.6 (2.8)		
Full-time equivalent (mean; (sd))	0.68 (1.7)		
Job satisfaction (mean; (sd))	2 4 (0 4)		

[a] Including16 patients excluded from analysis; [b] GP= general practitioner; [c] NP = nurse practitioner

Preference

For seven of eight aspects of primary care, most patients preferred the general practitioner (Table 2). The great majority preferred the general practitioner for 'medical' aspects of care, such as medical treatment, discussing physical complaints, and getting information about their disease and prognosis. For six out of eights aspects, a fifth to a third of the patients had no clear preference for either the general practitioner or the nurse practitioner. Only for the provision of information and advice on how to deal with the disease did the majority of patients have a clear preference for the nurse practitioner (36.5%).

None of the measured patient, general practitioner/general practice or nurse practitioner characteristics predicted patients' preferences.

Table 2. Patients' preference, expressed as a percentage (n=101)

	No preference	Nurse practitioner	General practitioner
Medical care and treatment (n=96)	17 7	5 2	77 1
Discussing physical complaints (n=97)	14 4	6 2	79 4
Discussing emotional problems (n=82)	26 8	28.0	45 1
Information about disease and prognosis (n=93)	20 4	17 2	62 4
Education about medications (n=94)	29 8	19 1	51 1
Referral to other health care providers/ services (n=93)	32 3	9 7	58.1
Information and advice to deal with disease (n=96)	33 3	36 5	30 2
Follow-up of disease (n=96)	21 9	30 2	47 9

Satisfaction

Patients were generally very satisfied with the care provided by both nurse practitioners and general practitioners as shown in table 3. Although the satisfaction scores were similar for nurse practitioners and general practitioners across all items, nurse practitioners tended to receive slightly higher scores. Significant differences in satisfaction, favouring the nurse practitioner, were found in relation to length of consultation, reassurance about symptoms, information on coping with disease, and attention to the impact of disease on daily life.

Univariate multilevel linear regression analysis (cut off $p \leq 0.15$) showed that satisfaction with nurse practitioners (dependent) was significantly associated with the frequency of contacts with nurse practitioner and the job satisfaction scores of general practitioners. In multivariate multilevel linear regression analysis, only frequency of contacts with the nurse practitioner in the last six months was significantly associated with higher overall satisfaction with the nurse practitioner. Satisfaction increased as the number of contacts with the nurse practitioners increased (0.05 (95% CI, 0.001 to 0.10). This characteristic explained 4.3% of the total variance.

Univariate multilevel linear regression (cut off $p \leq 0.15$) showed that satisfaction with general practitioners (dependent) was significantly associated with patients' gender, self-reported health and frequency of contacts with the general practitioner. In multivariate multilevel linear regression analysis only poor self-reported health was significantly associated with higher overall satisfaction with general practitioners. Satisfaction increased as the patient felt sicker (0.36 (95% CI, 0.05 to 0.66). This explained 3.4% of the total variance.

None of the other characteristics of patients or general practitioners/general practices were associated with overall satisfaction scores. For both scores the largest part of the variance was exaplained by differences between individual patients (about 85-90%); only 10-15% of the variance was explained by differences between general practices and nurse practitioners.

Table 3. Patients' satisfaction with primary care[4], expressed as mean score (95% confidence interval of the mean), including results of mixed repeated measurement analysis, expressed as mean difference (95% confidence interval of the mean) and level of significance (p-value)

	Nurse practitioner	General practitioner	Mean difference (95%CI); p-value
Overall Satisfaction score	4.4 (4 15 to 4 61)	4.1 (3.86 to 4.38)	0.24 (0 02 to 0.46) ; p=0 03
Continuity			
- Knows which symptoms have been discussed before	4.4 (4 41 to 4 48)	4 3 (3.95 to 4.55)	0.18 (-0.15 to 0.51), p=0 29
Cooperation			
- Knows what other provider has done/treatment is	4.3 (4 07 to 4 62)	4 5 (4.24 to 4.77)	-0.17 (-0 07 to 0.40); p=0.16
Relation and communication			
- Shows understanding of what the patient says	4.5 (4 23 to 4 73)	4.4 (4.07 to 4.66)	0.11 (-0.20 to 0.42); p=0.48
- Takes enough time to talk	4.5 (4 29 to 4 76)	4.1 (3 22 to 4.99)	0.40 (0 13 to 0 66), p=0 004
Information and advice			
- Gives opportunity to ask questions	4.6 (4.31 to 4.81)	4.4 (4.14 to 4.71)	0.11 (-0.15 to 0.37); p=0 41
- Says clearly what s/he is doing	4.6 (4 33 to 4 85)	4.3 (4 01 to 4.60)	0.24 (-0.07 to 0 55); p=0 13
Medical care			
- Treatment helps to reduce symptoms	4 1 (3 70 to 4 41)	4.1 (3.73 to 4.36)	0.05 (-0.26 to 0 36), p=0.75
- Provides advice that can actually be implemented	4.3 (3 99 to 4.55)	4.2 (3 87 to 4 49)	0.05 (-0.25 to 0 34), p=0.75
Support			
- Reassures the patient with regard to symptoms	4.3 (4.03 to 4 54)	4.0 (3.68 to 4.26)	0.36 (0 08 to 0 65), p=0 01
- Helps to cope with the disease	4 3 (4 03 to 4 59)	4.0 (3 69 to 4 31)	0 34 (0 06 to 0.62), p=0 02
- Attends to the impact of the disease on daily life	4.3 (4.05 to 4.59)	3.9 (3 62 to 4 23)	0 40 (0 09 to 0 71), p=0 01
- Provides support for patient's relatives	4 0 (3 62 to 4 45)	4.0 (3.59 to 4.38)	0.18 (-0 18 to 0 54); p=0 33
- Involves patient's relatives in treatment	3 8 (3 34 to 4.25)	3.7 (3 24 to 4 12)	0.16 (-0 22 to 0 54); p=0.41

[4] Higher score reflects better evaluation of care

Discusion

The findings suggest that patient preference varies with the type of care required. Doctors were evidently preferred for medical problems, whereas for routine care or educational or supportive interventions about 50% of the patients preferred nurses or had no preference. Patients tended to have no preference, instead of a pronounced preference, for nurse practitioners for most aspects of care. Patients obviously preferred talking to nurse practitioners about aspects related to coping with the disease. The majority of the patients were very satisfied with both the nurse practitioner and the general practitioner. Patients were more satisfied with the nurse practitioner for certain aspects of care, including support for patients and their relatives, and length of consultation. Variations in preference and satisfaction were most strongly associated with variations in individual patient characteristics.

Comparison to other studies

Unique in our study is the assessment of factors determing patients' preference and satisfaction with nurse practitioners, and the assessment of satisfaction with both the nurse practitioner and with the general practitioner by the same patient Most studies have focussed on the evaluation of general practitioners, not nurse practitioners Studies focused solely on doctors will miss factors that the majority of doctors possess but distinguish doctors from other health professionals By including both nurses and general practitioners, our study is better able to identify the determinants of patient preference and satisfaction with care

The study is also unique as clustering of patients within general practice and by practitioner has been taken into account Sixma and colleagues are among the few who have taken differences among doctors and practices into account using a multilevel analysis approach [27 28] In agreement with our findings, the larger part of the variance in patient satisfaction scores was attributed to patient level factors (90-95%) Less then 10% was explained by doctor or general practice characteristics

It remains, however, unclear which patient characteristics best predict satisfaction In our study poor self reported health explained 3% of the variance in satisfaction with general practitioners, and frequency of consultation with the nurse practitioner explained 4% of the variance in satisfaction with nurse practitioners Other measured characteristics had no significant effects

Our findings on preferences support those of a previous qualitative study,[29] patients preferred to consult general practitioners for 'medical' treatment in particular if they perceived their symptoms to be serious Nurses were preferred for reassurance and minor illnessess We did not, however, find any relationship between self-reported health and preference While we found no relationship between preferences and patient or practitioner characteristics, Redsell and collegues[29] found that factors affecting preference and satisfaction may include confusion about the nurse's (new) role and uncertainty about the expertise of nurses Redsell and collegues[29] and Williams & Jones[30] also found length of consultation to be another influential factor From the analysis of nurses' work[21] we know that the nurse practitioners spent an average 24 minutes per consultation, which is two to three times longer than general practitioners [31 32] Longer consultations may enable nurses to incorporate health education information into the consultation and to really understand, explore and address underlying (emotional) problems [30] This may explain why patients in our study were more satisfied with the nurse practitioner, in particular in relation to 'support' aspects such as reassurance about symptoms, information on coping with disease and the impact of the disease on daily life Yet, patients' views on the value of 'extra' time

were mixed.[29,30] In particular patients that felt healthy did not feel the need to see nurses as frequently as suggested.[30] Furthermore, other studies have shown that patients value continuity of care and the possibility of building a trusting relationship.[5,29,30] This could explain why in our study an increased number of consultations with nurse practitioners was positively associated with satisfaction.

Although we have only limited insight into factors influencing patients' preferences and satisfaction, there are a number of strategies that can help to smooth the introduction of skill mix changes from patients' perspectives. Patients' perceptions and knowledge can for example be influenced by newspaper articles, other multi-media (for example documentary, radio), information leaflets, communications about own and other patients' experiences, letters from the general practitioners or health authorities, et cetera.[5] General practitioners are in the position to encourage patients to build relationships with nurse practitioners.

Study limitations

The response rate among patients to the self-administered questionnaire was relatively low (50%), so we cannot exclude selection bias in the results. Yet, respondents and non-respondents were comparable with regard to gender, age and diagnoses. We can only speculate about the reasons for non-response and the effect on the results. The questionnaires were distributed by the nurse practitioners. Patients who were dissatisfied with the nurse practitioner or with the general practitioner may not have responded, afraid that a negative evaluation might adversely affect their care. Some patients declined to participate because they saw the nurse too infrequently to make a judgement. As patients who were averse to seeing the nurse may well have had infrequent contact with her, these exclusions may have biased the results. Yet, other data showed that patients rarely refused to see a nurse practitioner. Therefore antipathy to nurses is unlikely to explain infrequent contact.[21]

This limitation means that overall levels of satisfaction might have been overestimated for both nurses and doctors, but most particularly for nurses. Our findings, however, agree with those of previous studies which measured patients' preferences and satisfaction with nurse-led care and doctor-led care.[3,4]

The analyses of factors influencing patient satisfaction and preferences are less vulnerable to response bias.[33] The findings suggest that characteristics of the practice and practitioner explained little of the variation in patient satisfaction. One possible explanation is that there were too few nurses, doctors and practices to detect associations of importance. Another possible explanation is that variation in outcome measures was too small as patients were very satisfied with both nurse-led and doctor-led care. A more likely

explanation is, however, that individual patient characteristics are more important than health care organisation in determining preference and satisfaction.

Conclusion

Patient satisfaction with primary care appears high irrespective of whether care is delivered by nurses or doctors. Patients do, however, make distinctions between nurses and doctors in terms of which types of care they believe each practitioner is best at providing. Patients should therefore be informed about the competence of different health care providers and the safety of the services provided by those providers. It is important to keep this matter under review as skill mix changes in care provision are continually changing. It is perhaps reassuring to have found that changes in practitioners' roles may have relatively small effects on overall satisfaction. Changes to the quality of communication processes such as the degree of patient centredness, opportunities for shared decision making, and degree of patient empowerment, may have a much larger impact on satisfaction.

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Chapter 8

The introduction of a nurse practitioner to the general practice team: experiences, opportunities and bottlenecks

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Abstract

The increasing workload of general practitioners can be alleviated by deploying extra assistance at general practices. Successful introduction of nurse practitioners in general practice seems to depend on a number of factors. By means of an example, we show that during the initiation stage, agreements must be made about the tasks and patients groups that can be taken on by nurse practitioners. Attention must also be paid to education and supervision of the nurse practitioners. In addition, if nurse practitioners are to work efficiently, they need to have their own treatment room. The introduction of nurse practitioners in general practice is time-consuming, but general practitioners, practice assistants and nurse practitioners had a positive attitude. They saw clear potential for themselves and for the patients.

Introduction

Changes in the health care service have led to increases in the responsibility, tasks and workload of general practitioners. It is possible that a proportion of this care could be taken over by nurse practitioners. For example, nurses could be deployed to provide patient education, patient guidance and to coordinate care (liaison tasks). Consequently, the general practitioners could focus more closely on making diagnoses, treating patients with more complex disorders and managing the general practice.

Practice support abroad

In other countries, care organisations have been gaining experience with the deployment of nurse practitioners to support general practitioners since 1960. Nurse practitioners have evolved from assistant status into independent autonomous professionals. Nowadays, they provide care for, amongst others, patients with chronic diseases, such as diabetes and asthma.[1,2] In addition, they can be deployed to perform preventive tasks, for example in the field of cardiovascular diseases and hypertension.[3-5] Patients with minor illnesses are able to contact the nurse practitioner directly.[6,7] At present, there is wide variation in the range of work and training of nurse practitioners.[8,9]

The covenant: assistance in general practice

In 1999, the National Association of General Practitioners (LHV), National Organization of Health Insurance (ZN), and Ministry of Health, Welfare and Sport (VWS) signed an agreement that described the importance of providing assistance to general practice through the appointment of extra personnel. General practitioners were offered the opportunity to employ nurse practitioners for tasks that required training at a higher vocational level. These employees were intended to assist the general practitioner in the execution of regular general practice care, particularly for patients in specific categories such as those with chronic disorders. There was no strictly defined task list for the range of work of nurse practitioners. The deployment of nurse practitioners should be tailored to the needs of the general practitioners and good agreements must be made with other care providers in the region.[10]

The general practitioner and the nurse practitioner in 'Midden Brabant': an example

Rationale for the project

The increasing workload of general practitioners and concerns that, without extra support, the quality of general practice care would decrease led to agreement between the Local Association of General Practitioners (DHV Midden Brabant) and Local Community Nursing Authorities (Thebe) that general practices should be supported to recruit nurse

practitioners. Subsequently, the above-mentioned bodies held meetings with regional health insurance companies (VGZ and CZ) to request funding for the project. One year later, in November 1997, financing had been agreed for a period of two years and the initiation phase (of about one year) could be started. The aim was to measure how the deployment of nurse practitioners in general practice affected the quality of care and the workload of the general practitioners. Positive results would mean that financing for nurse practitioners could be extended throughout the region.

Recruitment of general practitioners and nurse practitioners

All local groups of general practitioners in the region were invited by letter to participate in the project. The local group of general practitioners could volunteer to participate provided that all the general practitioners in the local group supported the initiative and there were no internal conflicts. One general practitioner in the local group was responsible for the supervision of the nurse practitioner. This general practitioner was also the spokesman for the DHV, Thebe and the project coordinator (supervisor).

Nurse practitioners were recruited via the Local Community Nursing Authorities (Thebe). District nurses with a minimum of two years of experience were invited to apply. An interview was then held with the applicant, the community nursing authorities and the local group of general practitioners concerned. The district nurses were detached to the local group of general practitioners for a period of two years. Box 1 shows the profile of a nurse practitioner.

Box 1. Profile of a nurse practitioner

- minimum of 2 years of experience
- flexible, creative and able to work independently
- capacity to balance diverse interests
- focus areas must match the local group of general practitioners
- capacity for critical thought and help with decisions about the further contents of the job
- can work under pressure
- prepared to follow training and refresher courses in the field of clinical practice, other necessary education and skills
- knowledge of the social network in the neighbourhood/region
- capacity to liaise and maintain contact with other health professionals, e g. introduction

Tasks

The extra support from the nurse practitioner should lead to lightening of the general practitioner's workload, structured policies for chronic disease management, systematic provision of preventive care, and improved cooperation with community nursing professionals. In order to achieve these goals, the nurse practitioner was given two main tasks: firstly, care coordination in which the nurse practitioner acted as liaison with the

community nursing organisation and the hospital, and secondly, taking on tasks within the general practice that were delegated by the general practitioner. The DHV board of directors, Thebe and the Centre for quality of care research (WOK), in cooperation with the general practitioners in the region, established which patient groups could be taken on by the nurse practitioner.

It was decided that the list of tasks should initially be limited, but extended later to other patient groups and activities as required. The agreed guidelines regarding target groups and tasks aimed to offer structure to the nurse practitioner, the general practitioners and the practice assistants. The agreed guidelines included task delineation and the responsibilities of the different practice personnel. Another important advantage of the agreed guidelines was the opportunity it offered for the nurse practitioner to be trained rapidly in the tasks and patient groups described. It would be impossible to instruct the nurse practitioner in widely varying tasks and for all patient groups. Nurse practitioners were deployed in the care of patients with asthma, Chronic Obstructive Pulmonary Disease (COPD), dementia, cancer and patients on a waiting list. The major duties were providing information, supervising patients and liaison tasks. In addition, the nurse practitioner could carry out specific (diagnostic) tests and was also responsible for making inventories of the home and care situation of the patient. The range of work of the nurse practitioner was in line with the activities described in guidelines of the Dutch College of General Practitioners (NHG)[11-14], and in the folder for the promotion of skills[15]. The general practitioner referred patients to the nurse practitioner and was free to decide which tasks and patient groups he wished to delegate to the nurse practitioner. Box 2 gives a list of the range of work of nurse practitioners.

Box 2. Nurse practitioners: a job description

Target population: patients with chronic obstructive pulmonary disease (COPD), asthma, dementia, or cancer or patients on a waiting list for a rehabilitation centre or nursing home

Range of work: supplementary diagnostic procedures (lung function tests, hetero anamnesis, cognitive tests), (systematic) check-ups of chronic diseases, making inventories of problems, patient education, counselling, and liaison activities (coordination of care).

Working method: Firstly, patients were referred to the nurse practitioners by the general practitioners The general practitioners formulated the care requirement. Referral was done in writing, if necessary with a verbal explanation. After the first visit, the nurse practitioner (usually in consultation with the general practitioners) decided what type of care was required and whether it was necessary for the care to be continued The nurse practitioners had access to the electronic medical patient files and recorded the most important findings in the medical file of the patient If necessary, verbal feedback was given to the general practitioner.

Working hours: 32 to 40 hours per local group of general practitioners

Educational training

A training course was also developed for the nurse practitioners. The course comprised six modules and took two weeks, with a total of 56 hours. Nurse practitioners received training in the care of patients with asthma, COPD, dementia and cancer. In addition, they learned how to use the computerized medical record system (CMRS), such as searching for patient data and recording data. The juridical aspects (e.g. Law BIG) and the responsibilities of nurse practitioners were also discussed. The training course was developed by the DHV and Thebe; Glaxo Wellcome provided several modules.

Supervision

To supervise the local groups of general practitioners and the nurse practitioners, an independent project coordinator was appointed. It was this person's task to help the general practitioners and nurse practitioners to further map-out the job of the nurse practitioner, to help them find a suitable treatment room for the nurse practitioner to work in, to help them make agreements about the division of tasks and time of the nurse practitioner among the general practitioners in the local group, to organize further education, and to stimulate work discussions and the exchange of experience. The project coordinator also helped general practitioners and nurse practitioners to resolve any problems or disputes between them.

Introduction to patients

To make it known to patients that there was a nurse practitioner at the general practice, a poster was hung up in the waiting rooms. Also, a folder was made available. Patients could not consult the nurse practitioner directly, but had to be referred by their general practitioner.

Setting

Starting in September 1998, five nurse practitioners provided support for 30 general practitioners (20 general practices, 4 local groups). Each group of general practitioners received 32 to 40 hours of support per week from a nurse practitioner. General practitioners all had access to nurse practitioner support, but no agreements were made about how much of the nurses' time each would get. Sixty per cent of the general practitioners had a single-handed practice. The general practitioners worked for an average of 33 hours per week. A full-time general practitioner had an average of 2611 patients registered (65% with national health insurance). For each full-time general practitioner, 0.84 fte nurse practitioner was available.

General practice support provided by the nurse practitioners

In a period of 18 months, the general practitioners referred 1793 patients (60%) women, 49% > 65 years) and the nurse practitioners had 9942 consultations with patients or with other health professionals about the patients. The nurse practitioners were chiefly deployed in the care of COPD and asthma patients (50%). In addition, nurse practitioners took on a considerable number of patients (16%) that were not described in agreed guidelines, for example patients with diabetes, hypertension and cardiovascular diseases. Patient counselling was by far the most important task of the nurse practitioners. The majority of patients were visited at home. In the first six months, the nurse practitioners took more time to complete a consultation than in the last six months. For a detailed description of the support provided, the reader is referred to another publication.[16]

Experience of the general practitioners with the nurse practitioner

The general practitioners were interviewed after about six months to make an inventory of their experience and the bottlenecks with the support provided by the nurse practitioner (focus group interviews). After 18 months, 21 out of the 30 general practitioners filled in a questionnaire (response rate 70%). Table 1 gives an overview of the factors that affected the implementation of nurse practitioners in general practice.

Table 1. Overview of the factors that may have influenced the implementation of nurse practitioners (NPs) in absolute numbers (percentages)

	Never been a problem	Problem solved	Still a problem
• insufficient possibilities to delegate tasks to the NP	8 (40)	6 (30)	6 (30)
• NP works insufficiently independently	13 (62)	8 (38)	0 (0)
• large time investment by GP in development of NP job	7 (33)	11 (52)	3 (14)
• insufficient time for staff meetings	12 (57)	2 (10)	7 (33)
• discussing NP's work in the local group cost too much time	12 (57)	3 (14)	6 (29)
• resistance from the patients	20 (95)	1 (5)	0 (0)
• resistance from the practice assistant(s)/practice nurses	16 (76)	5 (24)	0 (0)
• resistance from other health professionals	20 (95)	1 (5)	0 (0)
• insufficient possibilities at the practice for optimal functioning of the NP	11 (52)	6 (29)	4 (19)
• insufficient financial compensation from the GP	10 (50)	1 (5)	9 (45)

NP= nurse practitioner, GP= general practitioner

Range of work

Six months after the start of the support project, the general practitioners were satisfied with the basic range of tasks that had been developed for the nurse practitioner. It offered them sufficient possibilities to place the emphasis of care where it was needed, because *they* decided which patient groups and which tasks were referred to the nurse practitioner. Twelve out of the 21 general practitioners who filled in the questionnaire found it

important that the range of work had been defined in agreed guidelines before the start of the project. Despite this, general practitioners felt that the tasks needed to be extended in future.

Tailoring of care

After a patient had been referred to the nurse practitioner, the general practitioners found it unnecessary for the nurse practitioners to make a note of the care they had provided in the (electronic) patient medical record as well as give verbal feedback to the general practitioner. Verbal feedback was only relevant if the general practitioner was expected to take further action. The project coordinator discussed this point with the nurse practitioners and general practitioners. It was agreed that the nurse practitioner would make a note (short and to the point) of the most important findings in the patient medical record. Verbal communication about the patient would only take place when the nurse practitioner had questions or when it was necessary for the general practitioner to take further action. Although a few of the general practitioners felt that the nurse practitioner did not work sufficiently independently in the first phase of the project, all the general practitioners were of the opinion that the nurse practitioners carried out the delegated care independently after 18 months. The general practitioners reported that the nurse practitioner had sufficient expertise to carry out the tasks described in agreed guidelines.

Staff meetings

The general practitioners attributed great importance to holding regular meetings with the nurse practitioners. In their opinion, attention should not only be paid to patient care at these meetings, but also to the functioning of the nurse practitioners, supervision of the nurse practitioners, and the further development of the job. Although importance was attached to such staff meetings, this was very difficult to implement at some general practices. Even after 18 months, one third of the general practitioners still did not have sufficient time to hold staff meetings.

Treatment room

The majority of general practices had insufficient space to accommodate a nurse practitioner. Very few of the nurse practitioners had their own treatment room at the general practices. This hindered the nurse practitioners and was reflected in the number of home visits (76%) versus the number of consultations at the general practice (24%).

Lightening of the workload

After six months, the general practitioners reported that they were making too little use of the support from the nurse practitioners. They did not have the impression that their workload had decreased. Answers to the questionnaire showed that the general practitioners had mainly delegated tasks that they had not previously had time to do themselves. Thus, their workload could not be expected to become lighter in the short-term. A few of the general practitioners reported that in proportion, they needed to spend too much time discussing issues with or about the nurse practitioner in proportion to amount of their time saved by the nurse. Even after 18 months, 6 out of the 21 general practitioners found that they had to spend too much time on the development of the nurse practitioners' job. At the meetings of the local group of general practitioners, regular attention was paid to this issue.

Experience of the nurse practitioners with the job of nurse practitioner

Data collection from the nurse practitioners on their experience with the job took place by means of an interview after six months and by a questionnaire at 18 months, i.e. the same procedure as for the general practitioners. The response rate was 100%.

Range of work

The nurse practitioners felt that they were sufficiently skilled to carry out the tasks described in the agreed guidelines. They expressed the wish to follow periodic refresher or further education courses. The agreed guidelines offered the nurse practitioners a firm footing in the initial stages. In the course of the project, the tasks were extended and new patient groups were added. Verbal agreements were made about these tasks and for a few patient groups, protocols were set up. An important point was the delineation of tasks for the nurse practitioners and other health care professionals, such as practice assistants and district nurses. It was very important that clear agreements were reached about the issue of task delineation. One of the nurse practitioners remarked that at busy times during surgery hours, she helped the practice assistant with her tasks, for example, measuring blood pressure, syringing ears and performing blood tests for glucose levels.

Staff meetings

The nurse practitioners reported that it was often difficult to hold staff meetings at the general practices. Two out of the five nurse practitioners mentioned that they found it important for the practice assistants to be present at the meetings. Besides holding staff meetings with the general practitioner, the nurse practitioners reported they valued attending regular meetings of the local groups.

Lightening of the workload

After six months, the nurse practitioners were not yet providing optimal support for the general practitioners. The range of work varied widely from week to week and among general practitioners. During the course of the project, the nurse practitioners built up their "own" patient list. The majority of referred patients remained under the care of the nurse practitioners. After 18 months, the nurse practitioners were mainly carrying out tasks that had *not* been conducted previously by the general practitioners. Therefore, lightening of the general practitioners' workload was not to be expected.

Experience of the practice assistants with a nurse practitioner

After about 18 months, a random sample of 12 practice assistants were interviewed by telephone and 17 out of the 20 practice assistants filled in a questionnaire (response rate 85%). Only one questionnaire per general practice was filled in.

Range of work and task delineation

For many of the practice assistants, it was not clear at the beginning of the project which tasks would be taken on by the nurse practitioners and what the influence would be on their own work. It became evident during the course of the project which tasks belonged to the nurse practitioners. All the practice assistants expressed a positive attitude towards the new situation. According to the practice assistants, there was hardly any shifting of tasks. When task shifts did occur, this was not viewed as a disadvantage.

The questionnaires showed that at 11 general practices, several of the tasks of the practice assistants had been taken over by nurse practitioners. These tasks included: lung function measurement, providing information for COPD and asthma patients, preventive care for cardiovascular diseases, and liaison with other health care professionals. According to half of the practice assistants, verbal agreements had been made about the division of tasks between the practice assistants and the nurse practitioners. The vast majority (82%) of practice assistants had a good working relationship with the nurse practitioner.

Staff meetings

The practice assistants held regular meetings with the general practitioner. It was unusual for the nurse practitioners to be present. At 6 out of the 20 general practices, staff meetings were held with all the practice employees. Four practice assistants found it important for the nurse practitioner to be present at the meetings.

Experience of district nurses and specialised (hospital) nurses with a nurse practitioner
After about 18 months, a random sample of 10 district nurses, three specialized nurses (COPD and asthma) and two waiting list supervisors were interviewed by telephone.

Range of work and task delineation
At the beginning of the project, the nurses did not know which tasks could be taken on by the nurse practitioners. Therefore, it was unclear how the job of the nurse practitioner would affect their own range of work. During the course of the project, the nurses made individual agreements with the nurse practitioners. These agreements chiefly concerned task delineation and tuning of the care that the two health professionals would provide. The opportunity to discuss patients and the care for these patients was regarded as an important advantage.

About 50% of the nurses were afraid that the presence of a nurse practitioner would mean further hollowing-out of their jobs as district nurses. They found it important that there be a clear delineation of tasks. Future such initiatives therefore need clearly to define and record the tasks and responsibilities of the various nurses.

Discussion
The greatest problem that arose in the initiation of the project was the lack of education programmes to train (community) nurses as nurse practitioners. Moreover, there was no consensus about the range of work of the nurse practitioner, and in the Netherlands, there was very little experience with deploying nurse practitioners to support general practice. In consultation with the DHV board of directors and the Local Community Nursing Authorities (Thebe), it was decided to set up a limited list of basic tasks for nurse practitioners. Although a few general practitioners had a say in the matter, this was a top-down procedure and the basic task list led to some degree of discussion at the local groups of general practitioners, particularly with regard to the choice of patient groups and the tasks that could be delegated. This experience showed that at an early stage, general practitioners, nurse practitioners and practice assistants should make agreements about the patient groups that will be referred and the tasks that will be delegated to the nurse practitioner. It is advisable to deploy the nurse practitioner for a limited number of patient groups and tasks in the early stages. Once the nurse practitioner support is running smoothly, the support can be extended to other patient groups and tasks. Linking this support to the wishes and needs of the individual general practice will produce an optimal effect. It seems that the greatest benefit can be achieved by delegating protocolized care, such as systematic management policies for chronically ill patients and preventive care.

Although the training programme was viewed very positively by the nurse practitioners, it appeared that there was a need for additional education during the project. In view of this, the nurse practitioners were offered the opportunity to follow educational courses for district nurses and/or practice assistants. The continuous offer of training for nurse practitioners seems essential for the maintenance of skills. Training programmes for the nurse practitioners are therefore to be recommended. The nurse practitioners can either follow existing courses or new ones developed to meet their particular needs.

The project showed that the nurse practitioners made a relatively large number of home visits and had relatively little contact with patients in the surgery. Very few nurse practitioners had their own treatment room at the general practice, which hindered their provision of care. The number of home visits and the administrative time can be minimized by giving the nurse practitioners their own treatment room, complete with a computer with direct access to the CMRS, for a minimum of a few days per week.

Finally, a number of other points deserve attention. It is important that other health care professionals, as well as patients, are informed about the impending arrival of a nurse practitioner and that there is good communication. In this way, defensive attitudes from other health care professionals (e.g. district nurses and (liaison) nurse specialists) can probably be avoided. In addition, an external project coordinator or supervisor, who oversees the implementation of the nurse practitioner, is of great value. The supervisor can make suggestions in problem situations, instigate discussions about (in)efficient deployment of the nurse practitioner, organize the educational courses, write protocols, stimulate and encourage enthusiasm among professionals, et cetera. Preferably, the supervisor should already have a good working relationship with the general practitioners and a well-organized network with other health care providers in the region before the project starts. Moreover, staff meetings between the nurse practitioners and general practitioners are essential for good patient care. Our experience and similar projects in the Netherlands[17-23] all showed that there is great enthusiasm for the nurse practitioners, but that implementation will benefit from good working agreements about the range of work and task delineation, and that training and the availability of a treatment room help to promote the introduction of this new role.

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Part III

Impact of two skill mix change models

Chapter 9

Substitution of doctors by nurses in primary care (Review)

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Abstract

Background. Demand for primary care services has increased in developed countries due to population ageing, rising patient expectations, and reforms that shift care from hospitals to the community. At the same time, the supply of doctors is constrained and there is increasing pressure to contain costs. Shifting care from doctors to nurses is one possible response to these challenges. The expectation is that doctor-nurse substitution will reduce cost and physician workload while maintaining quality of care.

Objectives. Our aim was to evaluate the impact of doctor-nurse substitution in primary care on patient outcomes, process of care, and resource utilization including cost. Patient outcomes included: morbidity; mortality; satisfaction; compliance; and preference. Process of care outcomes included: practitioner adherence to clinical guidelines; standards or quality of care; and practitioner health care activity (e.g. provision of advice). Resource utilization was assessed by: frequency and length of consultations; return visits; prescriptions; tests and investigations; referral to other services; and direct or indirect costs.

Search strategy. The following databases were searched for the period 1966 to 2002: Medline; Cinahl; Bids, Embase; Social Science Citation Index; British Nursing Index; HMIC; EPOC Register; and Cochrane Controlled Trial Register. Search terms specified the setting (primary care), professional (nurse), study design (randomized controlled trial, controlled before-and-after-study, interrupted time series), and subject (skill mix).

Selection criteria. Studies were included if nurses were compared to doctors providing a similar primary health care service (excluding accident and emergency services). Primary care doctors included: general practitioners, family physicians, paediatricians, general internists or geriatricians. Primary care nurses included: practice nurses, nurse practitioners, clinical nurse specialists, or advanced practice nurses.

Data collection and analysis. Study selection and data extraction was conducted independently by two reviewers with differences resolved through discussion. Meta-analysis was applied to outcomes for which there was adequate reporting of intervention effects from at least three randomized controlled trials. Semi-quantitative methods were used to synthesize other outcomes.

Main results. 4253 articles were screened of which 25 articles, relating to 16 studies, met our inclusion criteria. In seven studies the nurse assumed responsibility for first contact and ongoing care for all presenting patients. The outcomes investigated varied across studies so limiting the opportunity for data synthesis. In general, no appreciable differences were found between doctors and nurses in health outcomes for patients, process of care, resource utilization or cost. In five studies the nurse assumed responsibility for first contact care for patients wanting urgent consultations during office hours or out-of-hours. Patient health outcomes were similar for nurses and doctors but patient satisfaction was higher with

nurse-led care. Nurses tended to provide longer consultations, give more information to patients and recall patients more frequently than did doctors. The impact on doctor workload and direct cost of care was variable. In four studies the nurse took responsibility for the ongoing management of patients with particular chronic conditions. The outcomes investigated varied across studies so limiting the opportunity for data synthesis. In general, no appreciable differences were found between doctors and nurses in health outcomes for patients, process of care, resource utilization or cost.

Conclusions. The findings suggest that appropriately trained nurses can produce as high quality care as primary care doctors and achieve as good health outcomes for patients. However, this conclusion should be viewed with caution given that only one study was powered to assess equivalence of care, many studies had methodological limitations, and patient follow-up was generally 12 months or less.

While doctor-nurse substitution has the potential to reduce doctors' workload and direct healthcare costs, achieving such reductions depends on the particular context of care. Doctors' workload may remain unchanged either because nurses are deployed to meet previously unmet patient need or because nurses generate demand for care where previously there was none. Savings in cost depend on the magnitude of the salary differential between doctors and nurses, and may be offset by the lower productivity of nurses compared to doctors.

Background

Demand for primary care services has increased in many countries due to population ageing, rising patient expectations, and reforms that shift care from hospitals to the community. At the same time, the supply of doctors is constrained and there is increasing pressure to contain costs. Shifting care from doctors to nurses, is one possible response to these challenges.[1,2] A review of research into the substitutability of nurses for doctors suggested that 25% to 70% of the work undertaken by doctors might be moved to nurses.[3] In primary care, nurses may undertake much of the health promotion work of family practice,[4,5] and play a leading role in the routine management of chronic diseases such as asthma, diabetes and coronary heart disease.[6-8] The expectation is that primary care nurses working in extended roles can:

a) enhance the quality of services provided by doctors;
b) safely substitute for physicians in an wide array of services, so reducing demand for doctors; and
c) reduce the direct costs of services because nurse are cheaper to hire than doctors.

Nurses may work either as doctor supplements or as doctor substitutes. Nurses working as doctor supplements provide services which complement or extend those provided by doctors. The aim is to improve the quality of care and extend the range of services available to patients. In contrast, nurses working as doctor substitutes provide services which otherwise would be provided by doctors alone. The aim is to reduce the demand for doctors. Gains in service efficiency may be achieved if doctors give up providing the services they have delegated to nurses, and instead invest their time in activities that only doctors can perform.[9] This review is focused on the impact of nurses working as substitutes for primary care doctors.

Previous systematic reviews of doctor-nurse substitution in primary care have sought to identify whether nurses differ from doctors in terms of patient outcomes, process of care or resource utilization. In 1995, Brown and Grimes conducted a meta-analysis of American and Canadian research into doctor-nurse substitution in primary care.[10] Thirty-eight studies were included in the review, covering a wide range of nursing roles and encompassing both (quasi) experimental and observational research designs. The findings suggested that, as compared with doctor-led care, nurse-led care was associated with higher levels of patient compliance and satisfaction, longer consultations, and higher rates of laboratory testing. Health outcomes for patients were similar. These findings are supported by the more recent systematic review of Horrocks et al in 2002.[11] They included 11 randomized controlled trials and 23 prospective observational studies of nurses acting as doctor substitutes for patients with undifferentiated healthcare problems in primary care settings in developed countries. The findings suggested that patient health care outcomes were similar for

doctors and nurses, but that nurse-led care was associated with higher levels of patient satisfaction, longer consultations and higher rates of investigation.

Both reviews are awed in their inclusion of observational research which is susceptible to producing biased estimates of differences between doctors and nurses through failure to control for other factors that may affect outcome. In addition, by combining a diversity of nurse roles, it remains unclear whether the observed differences or similarities between nurses and doctors vary with the particular type of role substitution. We aimed to address these deficiencies.

Objectives

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

- Outcomes for patients
- Process of care
- Resource utilization
- Direct (service) and indirect (societal) costs

Criteria for considering studies for this review

Types of studies

Three types of study were eligible for inclusion:

- Randomized controlled trials (RCT): Random or quasi-random allocation of subjects to intervention and control groups.
- Controlled before-and-after studies (CBA): the intervention group is compared with a control group selected by non-random processes. Outcomes must be measured before as well as after the intervention.
- Interrupted time series (ITS). Longitudinal examination of outcomes with at least three observations before and again after the intervention.

Types of participants

- Doctors - primary care physicians which could include general practitioners, family physicians, paediatricians, general internists or geriatricians.
- Nurses - any qualified nurse working as a substitute to a primary care doctor. This could include: 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 trainee nurses and mental health nurses were excluded.
- Patients - presenting in primary care, excluding accident and emergency.

The review is limited to primary health care services that provide first contact and ongoing care for patients with all types of health problems. It includes family practice or general practice, outpatient settings, and ambulatory primary care settings (excluding accident and emergency).

Types of intervention

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. doctor) are transferred to a different type of professional (i.e. nurse), usually with the intention of reducing cost or addressing workforce shortages. 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 (specialized clinic vs routine consultation), and

b) who provides that service (physician or nurse)

Supplementation studies have been excluded from this review.

Some studies investigated complex interventions where practitioner care was combined with other interventions. Where a factorial study design was employed, the nurse can be compared with the doctor independently of other interventions. In such cases, we report only the effect attributable to the nurse compared with the doctor.

Types of outcome measures

Four types of outcomes were considered for this review, patient outcomes, process of care outcomes, resource utilization outcomes, and cost outcomes.

Patient outcomes

- Morbidity
- Mortality
- Quality of life/Health status
- Satisfaction

- Patient compliance
- Other (knowledge, preference for doctor or nurse)

Process of care outcomes
- Practitioner adherence to clinical guidelines
- Standards or quality of care
- Practitioner health care activity (examinations, provision of advice)

Resource utilization outcomes
- Frequency and length of consultations
- Return visits
- Prescriptions
- Tests and investigations
- Referral/use of other services

Cost outcomes
- Direct (service)
- Indirect (societal) costs

Search strategy for identification of studies

The following databases were searched: Medline; Cinahl; Bids Embase; Social Science and Citation Indexes; British Nursing index; HMIC; EPOC Register; Cochrane Controlled Trial Register (CCTR); and the National Primary Care Research and Development Centre's own database. The search terms combined Medical Subject Headings (MeSH) and free text words as shown in figure 1. The search was conducted first in 1999 (1966 till 1999) and then updated in 2002 (1999 till 2002). The updated search was restricted by study design.

The titles and abstracts of articles uncovered by the above searches were independently screened by two reviewers. The full text of potentially relevant articles was obtained for further evaluation. The reference lists of included articles, and of existing published reviews of doctor-nurse substitution, were checked for other potentially relevant studies. Only articles written in English or Dutch were included.

Figure 1. Search terms

Set 1 'Setting'	"Primary-health-care" OR "Primary-nursing-care" OR "Family-practice" OR "Physicians,-family" OR primary near care
Set 2 'Nurse profession'	"Nurse-clinicians" OR "Nurse-midwives" OR "Nurse-practitioner" OR "Nurse-administrators" OR "Community-health-nursing" OR nurs* OR nurse manager* OR district nurs* OR practice nurs* OR health visit*
Set 3 'Skill mix'	"Cooperative-behavior" OR "Job-description" OR "Professional autonomy" OR "Clinical competence" OR Clinical practice OR deleg* OR multidisplin* OR substitut* OR cooperat* OR role* OR skill mix OR health promotion or team* OR patient counselling OR nurs* near5 general pract*
Set 4 'Study design'	"Clinical-trials" OR "Controlled-clinical–trials" OR "Double-blind-method" OR "Single-blind-method" OR "Follow-up-studies" OR "Random-allocation" OR "Randomized-controlled-trials" OR "Evaluation-studies" OR "Prospective-studies" OR "Research-design" OR RCT OR randomised controlled trial* OR comparative stud* OR interrupted time series

The sets were combined with the 'AND' operation The above search terms were adapted to meet the specific requirements of each database

Methods of the review

Each potentially relevant study was independently assessed for inclusion in the review by two reviewers. Differences between the reviewers were resolved by discussion. A data extraction form based on the standard EPOC checklist was designed for this review. Data from each included study were extracted independently by two reviewers. 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. 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 physicians provided the same intervention as the nurse. Standard EPOC criteria were used to assess the methodological quality of the studies.

Analysis

Studies were grouped by nurse role for analysis, as follows:

- First contact and ongoing care for all presenting patients
- First contact care for patients wanting urgent attention
- Routine management of patients with chronic conditions.

For each group, meta-analysis was applied to outcomes for which there was adequate reporting of intervention effects from at least three randomized controlled trials. We excluded nonrandomized studies from meta-analysis due to their inherently greater potential for bias, and we excluded outcomes for which less than three randomized

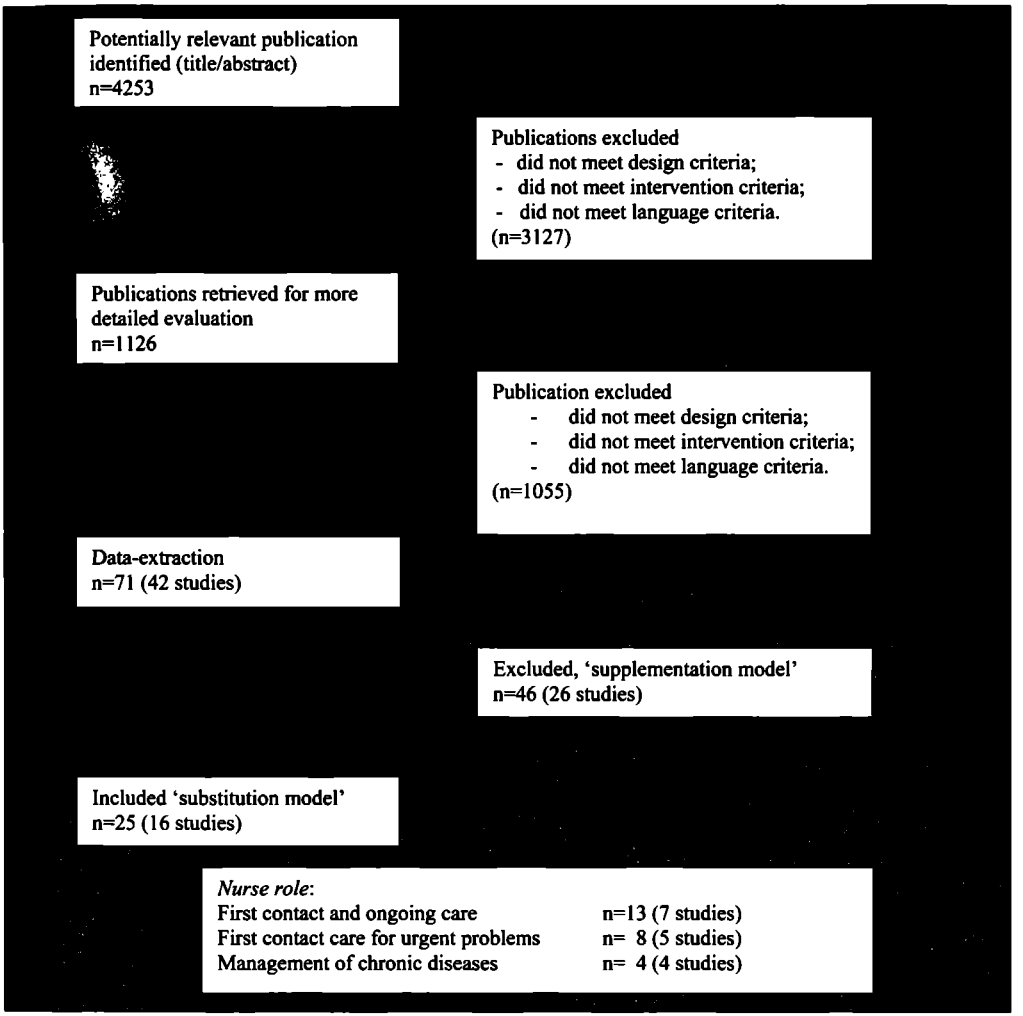
controlled trials were available on the grounds that a meta-analysis would not add substantial value to a semi-quantitative examination. Outcomes not amenable to meta-analysis were subjected to semi-quantitative synthesis. All results reported below are statistically significant unless otherwise stated. A fixed-effects (FE) model was used for all meta-analyses. A general recommendation is that, when there is evidence of substantial heterogeneity between study results, a random effects (RE) model should also be applied.[12] Despite significant heterogeneity, we decided against the use of RE models for two main reasons: (i) we had very small numbers of studies in each analysis - three at most; and (ii) we had no basis for assuming that effect sizes are normally distributed. These factors can result in RE estimates of overall effect and confidence intervals that are quite inaccurate[13-15] and, in our view, the risk of drawing an inappropriate conclusion from the analysis was too large to justify the use of RE models. In contrast, the FE model is known to provide accurate estimates of the average effect (and confidence interval) within the included studies even when the number of studies is small,[16] but does not provide a statistical basis for generalizing beyond the studies in hand.[17]

Description of studies

The initial searches identified 4253 potentially relevant articles (3784 in the original search, and 469 in the updated search) of which 25 articles, relating to 16 studies[18-33] met our inclusion criteria (Figure 2). We identified a further 32 studies[34-56] which investigated the role of nurses working as supplements to primary care doctors; these have been excluded from the review and will be reported separately.

In seven studies,[18-20,22,28,31] the nurse assumed responsibility for first contact and ongoing care for all presenting patients. In five studies the nurse assumed responsibility for first contact care for patients wanting urgent consultations during routine practice hours[23,29,30,33] or out-of-hours[24]. In four studies[25-27,32] the nurse had responsibility for the routine management of patients with particular chronic conditions. In one of these studies[26] the nurse provided counselling to problem drinkers. In all studies, the control or comparison group consisted of doctors providing the same services to patients as the nurses.

Figure 2. Trial flow



Methodological quality

Of the 16 studies included, three were controlled before-and-after studies[4,18,21,29] and 13 were randomized or quasi-randomized controlled trials[19,20,22-28,30-33] (See appendix; Table Characteristics of included studies). The methodological quality of controlled before-and-after studies[18,21,29] was assessed by nine quality criteria (Table 1).

None of the three controlled before-and-after studies reported the statistical power. In one study[18] the unit of allocation was the community, whereas the unit of analysis was the

patient with no allowance for clustering. In all three studies the intervention and control groups appeared to be comparable. Each study fulfilled four of the nine quality criteria.

Table 1. Methodological quality of included studies

Study	Power	Unit analysis error	80% follow-up a. professional b. patient	Comparability (CBA)/ Concealment (RCT)	Baseline Assessment	Blinded Assessment	Reliable Outcomes	Contamination
CBA								
Chambers[18]	Not clear	Not done	a Not clear b. Done	Done	Done	Done	Not clear	Not clear
Gordon[21]	Not clear	Done	a Not clear b Done	Done	Not clear	Done (resource) Not done (patient)	Not clear	Not clear
Myers[29]	Not clear	Done	a. Not clear b Done	Done	Not clear	Done	Not clear	Not done
RCT								
Chambers[19]	Not done	Not done	a. Not clear b Not done	Not clear	Done	Not clear	Not clear	Not clear
Flynn[20]	Not clear	Done	a. Not clear b. Done	Not clear	Not clear	Not done	Not done	Not clear
Hemani[22]	Not done	Done	a. Not clear b. Done	Done	Not clear	Done	Done	Not clear
Kinnersley[23]	Done	Done	a Not clear b Not done	Done	Not clear	Not done	Done	Not clear
Lattimer[24]	Done	Done	a. Not clear b. Done	Done	Not clear	Done	Done	Not clear
Lewis[25]	Not clear	Done	a. Not clear b. Done	Not clear	Not clear	Done	Not clear	Not clear
McIntosh[26]	Done	Done	a. Not clear b. Done	Not clear	Done	Not done	Done	Not clear
Moher[27]	Not clear	Done	a. Not clear b. Done	Not clear	Done	Done	Not clear	Done
Mundinger[28]	Done	Done	a. Not clear b. Not done	Not clear	Done	Done (resource) Not clear (patient)	Done (resource) Not clear (patient)	Not clear
Shum[30]	Done	Done	a Not Clear b. Done	Done	Not clear	Not done	Done	Not clear
Spitzer[31]	Not clear	Not done	a. Not clear b. Not clear	Not clear	Done	Done (mortality) Not clear (others)	Done (mortality) Not clear (others)	Not clear
Stein[32]	Not clear	Done	a. Not clear b Done	Not done	Not clear	Not clear	Not clear	Not clear
Venning[33]	Not clear	Done	a. Not clear b Not done	Done	Not clear	Not done	Done (health status) Not clear (others)	Not clear

The methodological quality of randomized controlled trials was also assessed by nine criteria (Table 1). All studies had methodological shortcomings. The power was reported in

five of 13 trials,[23,24,26,28,30] and two studies[19,22] reported that the study lacked the statistical power to detect clinically meaningful differences. Two studies[19,31] used cluster randomization without correcting for clustering in the analysis. Concealment of allocation was not reported in seven studies.[19,20,25-28,31] In 12 out of 13 trials[19-26,28-33] it was unclear whether or not contamination had occurred. Of the 13 trials, none fulfilled eight or more criteria; seven studies met four to seven criteria;[22-24,26-28,30] and six studies met three or fewer criteria[19,20,25,31-33].

Results

First contact and ongoing care for all presenting patients

Patient outcomes were assessed in five studies.[19-21,28,31] Health status was investigated in four of these;[19,21,28,31] 25 outcomes were measured of which two were significantly better with nurse-led care and 23 showed no significant difference. One of the two observed differences between nurses and doctors is untrustworthy in that the study[19] made no allowance for cluster randomization in the analysis. Patient satisfaction was assessed in three studies;[21,28,31] 15 outcomes were measured of which one was significantly better with doctor-led care and 14 showed no significant difference. Patient compliance was assessed in two studies;[20,21] four outcomes were measured and none differed significantly between doctors and nurses. Patient knowledge was assessed in one study;[20] three outcomes were measured of which one was significantly better with nurse-led care and two showed no significant difference (Table 2).

Table 2. First contact and ongoing care for all presenting patients: Patient outcomes

Chambers[19]	**Health status**
	- Physical function: nurse better
	- Emotional function: no difference
	- Social function. no difference
Flynn[20]	**Compliance**
	- Medication. no difference
	- Diet no difference
	Other, patients' knowledge:
	- Exercise: nurse better
	- Disease complications: no difference
	- Diet· no difference
Gordon[21]	**Health status**
	no difference
	Satisfaction
	- Subjective perceptions of clinical care (10 dimensions): no difference
	Compliance
	- Medication no difference
	- Kept appointment: no difference
Mundinger[28]	**Health status**
	- Number of health complaints: no difference
	- Subjective health status (10 dimensions) no difference

Table 2. First contact and ongoing care for all presenting patients: Patient outcomes

Mundinger[28]	**Health Status**
	Objective measures of patient health
	- Asthma - peak flow: no difference
	- Diabetes - blood sugar: no difference
	- Hypertension: systolic pressure: no difference
	- Hypertension: diastolic pressure: nurse better
	Satisfaction
	- 3 dimensions: no difference in overall satisfaction, but nurse worse on 1 dimension
	- Recommendation to others: no difference
Spitzer[31]	**Health status**
	- Physical function (3 indicators): no difference
	- Emotional function: no difference
	- Social function: no difference
	Mortality
	no difference
	Satisfaction
	no difference

Process of care was assessed in four studies.[18,20,21,31] Of the 12 outcomes measured, three were significantly better with nurse-led care. In two cases the nurse was significantly more likely than the doctor to provide lifestyle advice.[20] In one case, sub-group analysis suggested that the nurse had significantly fewer lapses in care when treating patients with unstable chronic disease.[21] The remaining nine outcomes showed no significant difference (Table 3).

Table 3. First contact and ongoing care for all presenting patients: Process of care outcome

Chambers[18]	**Quality of care**
	Adequate care
	- Clinical assessment: no difference
	- Drug treatment: no difference
Flynn[20]	**Practitioner health care activity**
	Recommendations on ordered diet
	- Diabetic: no difference
	- Low salt: nurse significantly higher frequency
	- Low calorie: no difference
	- Bland: no difference
	Recommendations on exercise
	- Increase activities: nurse significantly higher frequency
Gordon[21]	**Quality of care**
	Lapses in care: no difference
	Subgroup
	- Stable patients: no difference
	- Unstable patients: nurse significantly fewer lapses
Spitzer[31]	**Quality of care**
	Adequate treatment
	- Drug treatment: no difference
	- Management of episodes: no difference

Resource utilization was assessed in three studies.[20,22,28] Consultation rates were investigated in two studies[22,28] and neither found a significant difference between doctors

and nurses. Tests and investigations were assessed in two studies;[20,22] 22 outcomes were measured of which four showed significantly higher rates for nurses and the remainder showed no difference. Use of other health care services was assessed in all three studies; seven outcomes were measured of which one showed a significantly higher rate for nurses[20] and the remainder showed no significant difference (Table 4).

Table 4. First contact and ongoing care for all presenting patients: Resource utilization outcomes

Flynn[20]	**Tests & investigations (11 indicators)** nurse significantly more tests for 4 indicators (electrocardiogram; bacteriology, urinalysis; minor X-ray); the remainder showed no difference **Use of other services** nurse-led care was associated with a significantly higher use of other services
Hemani[22]	**Consultations** - Consultation rate. No difference compared to qualified doctors; Nurse significantly more visits compared to trainee doctors. **Tests & investigations** - Lab tests (6 indicators): no difference **Use of other services** - Hospital admission: no difference - Emergency room visits: no difference - Specialty visits: no difference
Mundinger[28]	**Consultations** - Consultation rate: no difference **Use of other services** - Hospital admissions no difference - Emergency room visits· no difference - Speciality visits: no difference

Direct costs were assessed in two studies[18,31] and no significant differences were found (Table 5).

Table 5. First contact and ongoing care for all presenting patients: Cost outcomes

Chambers[18]	**Cost outcomes** Direct cost per 1000 patients per year: - nurses–increase of 26% from $68.130 to $85 690 - doctors – increase of 21% from $93.190 to $112.730
Spitzer[31a]	**Cost outcomes** Average cost per patient per year: - nurses - $297.01 - doctors – $285.67

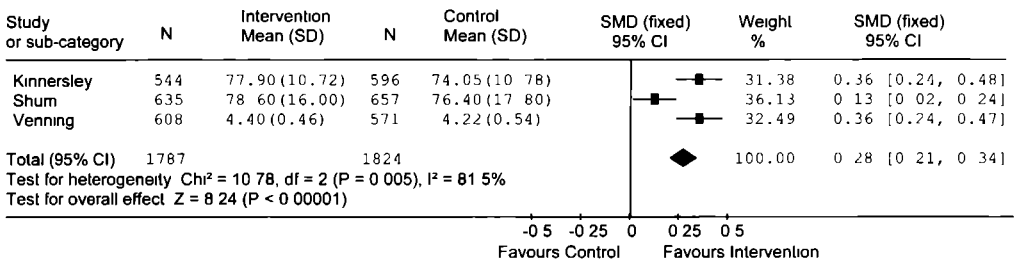
[a] Spitzer reported an overall reduction in practice costs following the introduction of nurse practitioners but this finding was based on observational before-and-after data Data obtained from the related randomized controlled trial (reported above) did not support this finding.

First contact care for patients wanting urgent attention

Patient outcomes were assessed in four studies.[23,24,30,33] Health status was investigated in all four studies; five outcomes were measured and none differed significantly between doctors and nurses.

Patient satisfaction was assessed in 3 studies;[23,30,33] 19 outcomes were measured of which 12 were significantly better with nurse-led care and seven showed no significant difference (Table 6). Meta-analysis of three studies[23,30,33] showed that patient satisfaction was higher with nurse-led care as compared with doctor-led care (standardized mean difference 0.28; 95% confidence interval: 0.21, 0.34) but the effect size was highly variable between studies (Figure 3).

Figure 3. Comparison Doctor-Nurse Substitution: Patient Satisfaction



Patient compliance and enablement were measured in one study[33] and no significant differences were found.

Table 6. First contact care for patients wanting urgent attention: Patient outcome

Kinnersley[23]	**Health status**
	- Rsolution of symptoms: no difference
	- Resolution of concerns: no difference
	Satisfaction
	- Child care: nurse significantly better
	- Adult care: no difference
	Other, preference
	no difference
Lattimer[24]	**Mortality**
	no difference
Shum[30]	**Health status**
	no difference
	Satisfaction
	- General: nurse significantly better
	- Professional care: nurse significantly better
	- Relationship to provider: no difference
	- Adequacy of time: nurse significantly better
	- Explanation helpful: no difference
	- Advice helpful. no difference
	Other, preference
	patients preferred nurse significantly more often

Table 6. First contact care for patients wanting urgent attention: Patient outcome

Venning[33]	**Health status**
	no difference
	Objective measures of patient health:
	- Asthma - peak flow: no difference
	- Diabetes - blood sugar: no difference
	- Hypertension. systolic pressure· no difference
	- Hypertension. diastolic pressure: nurse significantly better
	Satisfaction
	Adults
	- General: nurse significantly better
	- Communication: nurse significantly better
	- Distress relief nurse significantly better
	- Professional care nurse significantly better
	Children
	- General nurse significantly better
	- Communication with parent: no difference
	- Communication with child: nurse significantly better
	- Distress relief: nurse significantly better
	- Adherence intent: no difference

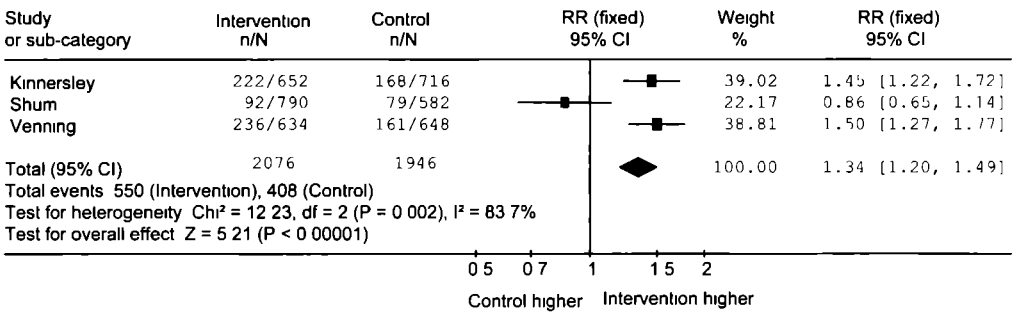
Process of care was assessed in three studies.[23,30,33] eight outcomes measured, six were significantly better with nurse-led care - all showing nurses provided more information to patients than did doctors. The remaining two outcomes showed no significant difference (Table 7).

Table 7. First contact care for patients wanting urgent attention: Process of care outcome

Kinnersley[23]	**Practitioner health care activity**
	Provision of information
	- Cause of illness: nurse significantly more
	- Relief of symptoms: nurse significantly more
	- Duration of illness nurse significantly more
	- Reduce recurrence· nurse significantly more
	- Action if problem persists: no difference
Shum[30]	**Practitioner health care activity:**
	Provision of infomation·
	- Self-medication nurse significantly more
	- Self-management: nurse significantly more
Venning[33]	**Quality of care**
	- Examinations: no difference

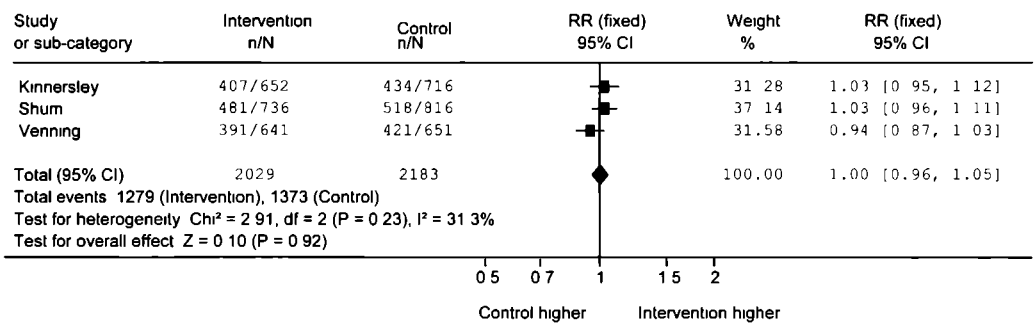
Resource utilization was assessed in five studies.[23,24,29,30,33] Consultation length was measured in three studies[23,30,33] and all showed significantly longer consultations for nurses (Table 8). Consultation rate was investigated in three studies;[23,30,33] five outcomes were measured of which three showed significantly higher rates for nurses and the remainder showed no difference. Meta-analysis of these three studies showed that nurses were more likely than doctors to recall a patient (relative risk nurse will recall patient compared with doctor = 1.34; 95% confidence interval: 1.20, 1.49) but with considerable heterogeneity across studies (Figure 4).

Figure 4. Comparison Doctor-Nurse Substitution: return visits



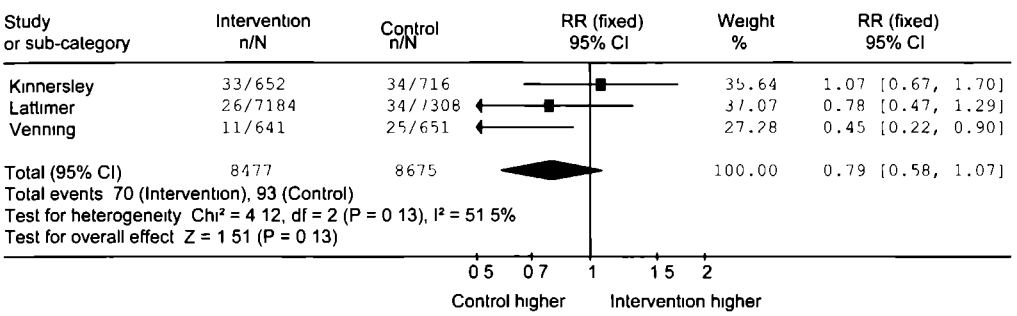
Prescribing rate was investigated in three studies;[23,30,33] five outcomes were measured of which one showed a lower rate for nurses and the remainder showed no difference. Meta-analysis of these three studies suggested there was no significant difference between doctors and nurses in prescribing rates (relative risk nurse will prescribe compared to doctor = 1.00, 95% confidence interval: 0.96, 1.05) (Figure 5).

Figure 5. Comparison Doctor-Nurse Substitution: prescriptions ordered



Tests and investigations were examined in two studies;[23,33] two outcomes were measured of which one showed a higher rate for nurses. Use of other services was investigated in five studies;[23,24,29,30,33] nine outcomes were measured and none showed a significant difference between nurses and doctors. Meta-analysis of three studies[23,24,33] suggested that there were no significant differences between doctors and nurses in referral rates to hospital (relative risk of referral by nurse compared to doctor = 0.79; 95% confidence interval: 0.58, 1.07) (Figure 6).

Figure 6. Comparison Doctor-Nurse Substitution: hospital referral



Doctors' workload was assessed in one study;[24] three outcomes were assessed, all of which showed a reduction in doctors' workload with nurse-led care (Table 8).

Table 8. First contact care for patients wanting urgent attention: Resource utilization outcomes

Kinnersley[23]	**Consultations**
	- Consultation length: Nurse significantly longer
	Return visit:
	- Recommended: no diference
	- Re-attend for same problem: no difference
	Prescriptions
	- Prescriptions: no difference
	Tests & Investigations
	no difference
	Use of other services
	- Referral to hospital: no difference
Lattimer[24]	**Consultations**
	- Telephone advice from doctor: significantly fewer with nurse-led care
	- Surgery visits: significantly fewer with nurse-led care
	- Home visits: significantly fewer with nurse-led care
	Use of other services
	- Hospital admission within 24 hours: no difference
	- Hospital admission within 3 days: no difference
	- Emergency room visit: no difference
	- Referred to hospital emergency room no difference
Myers[29]	**Prescriptions**
	- Prescriptions: nurse significantly less
	Use of other services
	- Referral: no difference
Shum[30]	**Consultations**
	- Consultation length: Nurse significantly longer
	- Return visit: no difference
	Prescriptions
	- Prescriptions: no difference
	Use of other services
	- Emergency room visit: no difference
	- Out-of-hours-calls: no difference

Table 8. First contact care for patients wanting urgent attention: Resource utilization outcomes

Venning[33]	**Consultations**
	- Consultation length: Nurse significantly longer
	Return visit:
	- All visits: nurse significantly more
	- Asked to return: nurse significantly more
	Prescriptions
	- All: no difference
	- Antibiotics: no difference
	Tests & Investigations
	nurse significantly more
	Use of other services
	- Referral to hospital: no difference

Costs were assessed in two studies.[24,33] One study[24] showed a net reduction in direct costs with nurse-led care while the other[33] found no difference (Table 9).

Table 9. First contact care for patients wanting urgent attention: Cost outcomes

Lattimer[24]	**Cost outcomes**
	Annual direct cost nurse-led service £81.237 more than doctor-led service
	Savings: generated in reduced hospital and primary care utilization equalled £94.422
	Net reduction in costs with nurse-led service £3.728 - £12.3824 (determined by sensitivity analysis)
Venning[33]	**Cost outcomes**
	Total direct cost per consultation:
	- nurses – mean £18.11 (range £0.66 - £297.1)
	- doctors – mean £20.70 (range £0.78 - £300 6)
	not significantly different

Routine management of patients with chronic conditions

Patient outcomes were assessed in four studies.[25-27,32] Health status was assessed in all four studies; eight outcomes were measured of which one was significantly better with nurse-led care[25] and seven showed no significant difference. Patient satisfaction was assessed in one study[25] and was found to be significantly higher with nurse-led care. Compliance was assessed in one study[25] and no significant difference was found. Patient knowledge was assessed in one study[32] and was found to be significantly higher with nurse-led care (Table 10).

Table 10. Routine management of patients with chronic conditions: Patient outcomes

Lewis[25]	**Health status**
	- Resolution of symptoms: nurse better
	Compliance
	- Kept appointment: no difference
	Other, preference
	nurse better
McIntosh[26]	**Health status**
	- Reduction in alcohol consumption: no difference

Table 10. Routine management of patients with chronic conditions: Patient outcomes

Moher[27]	**Health status**
	- Not smoking: no difference
	Objective measurement health status:
	- Blood pressure: no difference
	- Cholesterol: no difference
Stein[32]	**Health status**
	Objective measurement health status
	- Blood sugar: no difference
	- Weight no difference
	Mortality
	no difference
	Other, knowledge
	nurse better

Process of care was investigated in one study.[27] Of the four outcomes measured, none differed significantly (Table 11).

Table 11. Routine management of patients with chronic conditions : Process of care outcome

Moher[27]	**Quality of care**
	Adequate assessment
	- Clinical assessment: no difference
	- Blood pressure: no difference
	- Cholesterol: no difference
	- Smoking status: no difference

Resource utilization was assessed in two studies.[27,32] Consultation rate was examined in one study[32] and no significant difference was found. Prescribing rates were investigated in both studies; four outcomes were measured and none showed a significant difference (Table 12).

Table 12. Routine management of patients with chronic conditions: resource utilization outcomes

Moher[27]	**Prescriptions**
	- Anti-hypertensives: no difference
	- Lipid lowering: no difference
	- Antiplatelet: no difference
Stein[32]	**Consultations**
	- Consultation rate: no difference
	Prescriptions
	- Changed medication: no difference

Direct cost of care was assessed in one study[25] and no significant difference was found (Table 13).

Table 13. Routine management of patients with chronic conditions: Cost outcomes

Lewis[25]	**Cost outcomes**
	Total direct cost per year:
	- nurses - $3.251
	- doctors - $4.199
	Average cost per patient per year:
	- nurses - $98 51
	- doctors - $127.24

Discussion

The findings suggest that nurses and doctors generate similar health outcomes for patients, at least in the short-term, over the range of care investigated. This work included the provision of first contact and/or ongoing care for unselected patients and the management of patients with specific chronic conditions. The findings must be viewed with caution, however, given that only one study[24] (in which nurses provided first contact care for patients wanting urgent attention out-of-hours) was powered to assess equivalence of care.

Patient satisfaction was higher when nurses, as opposed to doctors, provided first contact care for people wanting urgent attention. Patient satisfaction with chronic disease management was also found to higher with nurse-led care, although this was investigated in only one study.[25] The reason for this difference is unclear and may relate to a number of factors. Nurses tended to have longer consultations than doctors, and patient satisfaction is higher with longer consultations.[58] Nurses also tended to provide more information to patients than did doctors which might also have enhanced satisfaction.

High satisfaction with nurse care did not, however, mean that patients inevitably preferred nurses to doctors. Patient preferences in most studies were mixed with some patients preferring to see nurses while others preferred to see doctors. Preference might partly relate to the nature of the presenting problem. Nurses may be preferred when the patient believes their problem to be 'minor' or 'routine' but doctors are preferred when the problem is thought to 'serious' or 'difficult'.[59]

Productivity was lower when nurses, as opposed to doctors, provided first contact care for people wanting urgent attention. Nurses tended to have longer consultation lengths and higher rates of patient recall while achieving the same health outcomes as doctors. This might be a learning effect whereby nurse productivity would improve as nurses gained more experience in their role.

However, two of the three studies which assessed productivity used experienced nurses[23,33]and only one[30] did not. Moreover, no appreciable differences were found between doctors and nurses in other aspects of resource utilization such as prescribing, use of tests or investigations, or referrals to other services. It therefore seems unlikely that the lower productivity of nurses as compared with doctors reflects their relative inexperience.

While no appreciable differences in resource use were found when nurses substituted for doctors in providing ongoing care for undifferentiated patients or those with particular chronic conditions, caseload (number of patients seen per unit of time) was not measured so productivity is unknown.

Only one[24] of five studies[23,24,29,30,33] in which nurses provided first contact care for patients wanting urgent attention out-of-hours, demonstrated clear cost savings with nurse-led services. In all other studies - spanning all three of the nursing roles considered in this

review - the lower salary costs of nurses were offset by their increased use of resources or lower productivity. As salary differentials between nurses and doctors may vary from place to place and over time, the net saving to health care services, if any, will be highly context dependent.[3]

Only one study[24] investigated the impact of nurses on doctors' workload and this showed reductions in the demand for doctors in which nurses provided first contact care for patients wanting urgent attention out-of-hours. However, a recent controlled trial of adding nurses to doctors' teams showed no reduction in doctor workload.[60] This may be because nurses addressed previously unmet need or because nurses generated demand where previously there was none. In either case, the findings suggest that the addition of nurses to doctor teams may not reduce workload unless active steps are taken to ensure doctors discontinue providing the services that have been transferred to nurses. Efficiency gains are possible if doctors invest this 'saved' time in activities that only doctors can perform.[9]

It is self-evident that nurses must be adequately trained to act as substitutes for doctors. There is, however, no agreement as to the level of training required for nurses to undertake the specific roles covered by this review, and no consistency in the qualifications nurses must have to merit job titles such as nurse practitioner. Few studies contained detailed information on the nature of nurses' training for the specific role under investigation, making it impossible for us to draw any conclusions as to whether or how training affects outcomes. All the studies included in this review adopted the position that the nurses they investigated were competent to carry out the clinical role assigned to them and, indeed, the evidence supports that assumption. Additional research is therefore needed to examine the relationship between training and outcome.

The limitations of this review need to be considered. Our search strategy was designed to maximize 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, particularly in the 'grey' literature that we did not search. Publication bias seems unlikely as the clinical and research communities are interested equally in whether nurses outperform doctors or the reverse. The inclusion of only English and Dutch language publications risks excluding potentially relevant work. We did, however, screen the English abstracts of papers published in other languages and found none that appeared relevant. Research into doctor-nurse substitution in primary care appears primarily to have been conducted in Canada, the USA and the UK which are English-speaking countries.

We restricted our meta-analysis to models. The FE approach provides reliable estimates of the average effect (and confidence interval) across included studies, but findings cannot

be generalized beyond these studies to the wider population of practitioners and practices. Therefore, where we have generalized beyond the studies in hand, this has been a qualitative judgement based on assessment of all the available evidence of which the meta-analysis is just one component.

Most studies included only small numbers of nurses and very few considered the potential for variation in outcomes by practitioner. This may have led to over precision in the estimates of differences between doctors and nurses. In addition, studies intended to demonstrate the comparability of nurse and doctor care need to be powered to assess the equivalence, not difference, of outcomes. This was done in only one study.[24] A final concern is the narrow range of nurse roles that has been subjected to rigorous evaluation. Nurses in many countries provide a far wider range of care than is represented in the current research literature. Doctor-nurse substitution in the management of patients with particular chronic diseases has been infrequently studied.

Implications for practice

The findings suggest that appropriately trained nurses can produce as high quality care as primary care doctors and achieve as good health outcomes for patients. Indeed nurses providing first care for patients needing urgent attention tend to provide more health advice and achieve higher levels of patient satisfaction compared with doctors.

Doctor-nurse substitution has the potential to reduce doctors' workload. However this benefit will not be realized in practice if physicians continue to provide the types of care that have been transferred to nurses. Doctors' workload may remain unchanged either because there was previously unmet need that nurses now fulfil or because nurses generate demand for care where previously there was none.

Doctor-nurse substitution has the potential to reduce the direct costs of care. Cost savings are, however, highly dependent on salary differentials between physicians and nurses and these may vary across locations and over time. In addition, savings on nurse salaries may be offset by nurses' longer consultation length and increased rate of patient recall relative to physicians, leading to no overall savings on cost.

Implications for research

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

The methodological quality of studies is variable. Future studies should seek to maximize the numbers of practitioners (particularly nurses), rather than numbers of patients, in order to reduce the effect of any individual practitioner on outcomes. Studies also need to adopt methods of statistical analysis that account for variation in outcomes between practitioners, to avoid over precision and an inated risk of type 1 errors (false positive results). Studies intended to demonstrate the comparability of nurse and physician care need to be powered to assess the equivalence, not difference, of outcomes. A final concern is the narrow range of nurse roles that has been subjected to rigorous evaluation. Nurses in many countries provide a far wider range of care than is represented in the current research literature. Related to this is the question of what levels of training and experience are required by nurses working as physician substitutes. The characteristics of nurses and physicians (numbers, training, experience) need to be reported more often and more consistently in studies in order to shed light on this issue.

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Appendix: Table Characteristics of included studies

First contact and ongoing care for all presenting problems

Study and design	Participants	Interventions	Outcomes	Study period	Nurse title
Chambers[18] CBA	2313 patients, all ages, 52% male 1 nurse Unknown number of doctors	*Intervention* two villages allocated to nurse-led care *Control* neighbouring villages allocated to doctor-led care	*Process of care*: standards of care *Resource utilization* direct costs	12 months	Practice nurse
Chambers[19] RCT	868 patients, all ages, 34% male 1 nurse 1 doctor	Intervention: families allocated to nurse-led primary care *Control*: families allocated to doctor-led primary care	*Patient outcomes*. health status	12 months	Practice nurse
Flynn[20] RCT	60 patients, age unknown, gender unknown 4 nurses Unknown number of doctors	*Intervention* patients allocated to nurse-led primary care *Control*: patients allocated to doctor-led primary care	*Patient outcomes* compliance with medication and diet; knowledge Process of care: suggested lifestyle changes *Resource utilization* tests and investigations; use of other health services	6-12 months	Nurse clinician
Gordon[21] CBA	169 patients, all ages, 38% female Unknown number of nurses and doctors	*Intervention* patients allocated to nurse-led primary care *Control*: patients allocated to doctor-led primary care	*Patient outcomes* health status, satisfaction; compliance with medication and follow-up attendance *Process of care* lapses in care	12 months	Nurse clinician
Hemani[22] RCT	450 patients, mean age 61 years, 98% male 9 nurses 45 doctors	*Intervention* patients allocated to nurse-led primary care *Control 1* patients allocated to trainee doctors (2nd, 3rd year residents) *Control 2* patients allocated to fully trained doctors (attending physicians)	*Resource utilization*: consultation rate; tests; use of other services-hospital admission, emergency room visits, specialty visits	12 months	Nurse practitioner
Mundinger[28] RCT	1316 patients, mean age 44.5 years, 25.5% male 7 nurses 17 doctors	*Intervention* patients allocated to nurse-led care *Control* patients allocated to doctor-led care	*Patient outcomes* health status, satisfaction *Resource utilization* consultation rate; use of other services - hospital admissions, emergency room visits, specialty visits	6 months	Nurse practitioner
Spitzer[31] RCT	4325 patients, all ages, 42.5% male 2 nurses 2 doctors	*Intervention* families allocated to nurse *Control* families allocated to doctor	*Patient outcomes*: health status; satisfaction, provider preference *Process of care* standards of care *Resource utilization* direct costs	12 months	Nurse practitioner

First contact care for patients wanting urgent attention

Study and methods	Participants	Interventions	Outcomes	Study period	Nurse title
Kinnersley[21] RCT	1465 patients, all ages, 40% male 10 nurses Unknown number of doctors in 10 practices	*Intervention*· patients allocated to nurse *Control* patients allocated to doctor	*Patient outcomes* health status, satisfaction; provider preference *Resource utilization* length of consultation; return visits; prescriptions, investigations; use other services-referral	2-4 weeks	Nurse practitioner
Lattimer[24] RCT	10134 patients, all ages, 48% male 6 nurses 55 doctors	*Intervention* incoming phone calls on randomly selected days were allocated to nurse telephone consultation. *Control*· incoming phone calls on other days were answered by a receptionist who passed the message to a doctor	*Patient outcomes*· mortality *Resource utilization:* doctor workload, use of other services - hospital referral and admission, emergency room visits, direct costs	3-7 days	Not clear
Myers[29] CBA	1000 patient contacts, mean age 35 5 years, 40% male 2 nurses 6 doctors	*Intervention* patients choosing nurse *Control*· patients choosing doctor	*Resource utilization* prescriptions; use of other services - referral	14 days	Nurse practitioner
Shum[30] RCT	1815 patients, mean age 27.5 years, 40% male 5 nurses 19 doctors	*Intervention* patients allocated to nurse Control: patients allocated to doctor	*Patient outcomes* health status, satisfaction; provider preference *Resource utilization:* length of consultation; return visits; prescriptions; use of other services - emergency room visits, use of out-of-hours services	2 weeks	Practice nurse
Venning[33] RCT	1316 patients, all ages, 42% male 20 nurses Unknown number of doctors	*Intervention* patients allocated to nurse *Control:* patients allocated to doctor	*Patient outcomes* health status, satisfaction; compliance with follow-up attendance; enablement *Resource utilizations* length of consultations, return visits; prescriptions; investigations; use of other services - hospital referral, direct costs	2 weeks	Nurse practitioner

Routine management of patients with chronic conditions

Study and methods	Participants	Interventions	Outcomes	Study period	Nurse title
Lewis[25] RCT	66 patients, 16+ years, 12% male Unknown number of nurses and doctors	*Intervention* patients allocated to nurse-led care *Control* patients allocated to doctor-led care	*Patient outcomes* health status, provider preference, compliance with follow-up attendance *Resource utilization* direct costs	12 months	Not clear
McIntosh[26] RCT	119 patients, mean age 31 5 years, 50% male 1 nurse 1 doctor	*Intervention* patients allocated to nurse *Control* patients allocated to doctor who provided identical treatment	Patient outcomes alcohol consumption	12 months	Nurse practitioner
Moher[27] RCT	1347 patients, mean age 66 years, 69% male Unknown number of nurses and doctors in 21 practices	*Intervention* patients allocated to nurse-led follow-up *Control* patients allocated to doctor-led follow-up	*Patient outcomes* cardio-vascular risk factors *Process of care* adherence to guidelines *Resource utilization* prescriptions	18 months	Practice nurse
Stein[32] RCT	23 patients, mean age 56 years, 0% male 1 nurse Unknown number of doctors	*Intervention* patients allocated to nurse-led care *Control* patients allocated to doctor-led care	*Patient outcomes* health status, mortality, knowledge *Resource utilization* consultation rate, prescriptions	6 months	Nurse practitioner

Chapter 10

The effectiveness of nurse supplementation in primary care: a systematic review and meta-analysis

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Abstract

Objective. To assess the impact of nurse supplementation on patient outcomes, process of care, resource utilization and costs-effectiveness.

Data sources. Nine electronic databases from inception to May 2005 and the reference lists of included papers.

Review methods. Studies were included if physicians supplemented by nurses were compared to doctors working alone in randomized controlled trial, controlled before-and-after study, or interrupted time series. Data were extracted independently by two reviewers. Meta-analysis (Weighted Fixed Effect) was conducted where feasible; other outcomes were subjected to semi-quantitative synthesis.

Results. 4618 articles were identified of which 56, relating to 32 studies, were included. For preventive services (n=15 studies), nurse supplementation was associated with fewer deaths in studies of elderly patients (Effect Size (ES), 0.141; 95% Confidence Interval (CI), 0.049 to 0.234) and increased use of special health services, such as alcohol counseling or home help (ES, 0.231; 95% CI, 0.124 to 0.338). For chronic disease management (n=17 studies), nurse supplementation was associated with improved clinical management (ES, 0.680; 95% CI, 0.594 to 0.767), leading to improved risk factor control (ES, 0.175; 95% CI, 0.1 to 0.25) and better self-reported health (ES, 0.107; 95% CI, 0.015 to 0.199). For both types of care, other outcome measures related to patients' health, satisfaction, process of care, resource utilization and costs showed either no difference or small improvements with nurse supplementation.

Conclusions. Adding nurse supplements to doctor teams improves the quality of care in both preventive care and chronic disease management. Health gains appear dependent on the effectiveness of the treatments delivered by nurses. Cost-effectiveness is unclear and requires further investigation.

Introduction

Developed countries face major challenges due to rising demand for health care, unacceptable variations in service access and quality, pressure to contain costs, and medical workforce shortages.[1-3] In primary health care, a common response to these challenges has been to extend the role of nurses.[4] The expectation is that nurses can improve access to health care services and quality at a lower cost than doctors so improving healthcare system efficiency.[5]

Primary care nurses may fullfill different roles; they may work either as doctor substitutes or as doctor supplements. Nurses working as substitutes provide the *same services* as doctors, whereas nurses working as supplements provide *additional services* which complement or extend those provided by doctors. Previous reviews[6-9] suggest that nurse subsitutes can achieve as good health outcomes as doctors in defined areas of care, but may not reduce costs or doctor workload.[9]

The effect of nurses working as doctors' supplements has not been subject to systematic review. Our aim was to synthesize existing research into the effects of nurse supplementation in primary care on patient outcomes, process of care, resource utilization and cost-effectiveness. We focused on studies where doctor only care was compared to that provided by doctors supplemented by nurses, irrespective of whether nurses worked largely autonomously or as part of a tightly integrated doctor-nurse team. We hypothesed that nurse supplementation would improve health outcomes and quality of care, but at reasonable increased resource use and costs.

Methods

A systematic review of published research was performed.

Searching

We searched Medline; Cinahl; Bids; Embase; Social Science Citation Index; British Nursing Index and HMIC (from their inception to May 2005); the Cochrane Central Register of Controlled Trials (Cochrane Library 2005; issue 2); and the Effective Practice and Organisation of Care Group (EPOC) Register (November 2004). The search strategy included terms to specify the setting, professional, study design, and subject area. Medical Subject Headings (MeSH) and free text words were combined as shown in figure 1. Although the search was not restricted by language, only papers published in English or Dutch were included. Titles and abstracts were screened, and full text copies of potentially relevant articles obtained. The reference lists of included studies were screened for other relevant publications.

The search was designed to maximize the detection of relevant skill mix studies in primary care, including both nurse substitution and nurse supplementation. Here we report the effects of nurse supplementation; the effects of nurse substitution are reported elsewhere.[9]

Figure 1. Search terms

Set 1 'Setting'	"Primary-health-care" OR "Primary-nursing-care" OR "Family-practice" OR "Physicians,-family" OR primary near care
Set 2 'Nurse profession'	"Nurse-clinicians" OR "Nurse-midwives" OR "Nurse-practitioner" OR "Nurse-administrators" OR "Community-health-nursing" OR nurs* OR nurse manager* OR district nurs* OR practice nurs* OR health visit*
Set 3 'Skill mix'	"Cooperative-behavior" OR "Job-description" OR "Professional autonomy" OR "Clinical competence" OR Clinical practice OR deleg* OR multidisplin* OR substitut* OR cooperat* OR role* OR skill mix OR health promotion or team* OR patient counselling OR nurs* near5 general pract*
Set 4 'Study design'	"Clinical-trials" OR "Controlled-clinical-trials" OR "Double-blind-method" OR "Single-blind-method" OR "Follow-up-studies" OR "Random-allocation" OR "Randomized-controlled-trials" OR "Evaluation-studies" OR "Prospective-studies" OR "Research-design" OR RCT OR randomised controlled trial* OR comparative stud* OR interrupted time series
The sets were combined with the 'AND' operation. The above search terms were adapted to meet the specific requirements of each database.	

Selection and study characteristics

Studies were included if doctors working alone (control condition) were compared to nurses working as doctors' supplements (intervention condition) in a randomized controlled trial (RCT), controlled before-and-after study (CBA), or interrupted time series (ITS) design. Any qualified nurse working to supplement the care of a primary care physician was eligible. Studies dealing with trainee nurses or specialist mental health nurses were excluded.[10,11] The review was limited to primary health care settings, including: family or general practice; outpatient settings; and ambulatory primary care settings, excluding accident and emergency. Study selection was carried out independently by two reviewers (ML,BS), and differences reconciled by discussion.

Validity assessment and data abstraction

Two authors (ML, BS) independently reviewed all included articles with differences reconciled by discussion. The following variables were extracted from each article using a standardized data proforma: source; publication date; country; characteristics and number of participants (i.e. doctors, nurses and patients); clinical domain; and intervention and control condition. Outcomes included: patient outcomes; process of care measures; resource utilization; and (in)direct health care costs and cost-effectiveness.

Study quality was assessed against published criteria that included: i) concealment of treatment allocation (RCT) or comparable primary outcomes at baseline (CBA); ii) blinding of outcome assessment; and iii) whether the proportion of patients followed-up was 80% or better.[12,13] An overall measure of quality (range 0-4 points) was created by awarding one point for each quality indicator that was met plus an additional point if the study was a RCT as this design provides the highest standard of evidence. Studies were then divided into two categories of methodological quality: high quality rated 3-4 point, and low quality rated 0-2 points.

Data synthesis

Studies were to divided according to nurses' roles into two categories: a) preventive health services, and b) chronic disease management. Within each category, outcomes were grouped as follows:

a) *patient outcomes* (8 groups): mortality, risk factors, diagnosed health status, patient reported health, treatment adherence, satisfaction, preference, and other;
b) *process of care outcomes* (4 groups): record keeping, clinical management, service access, and physician workload;
c) *resource utilization and cost-effectiveness outcomes* (5 groups): number of consultations, duration of consultation, number of prescriptions, number of tests and investigations, and costs and cost-effectiveness.

Outcomes for patient subgroups (e.g. men and women; high risk groups) were excluded from meta-analysis, unless these were integral to a study's design or aim, or overall outcomes were not reported. Outcomes for which an effect size could not be calculated or significance was unknown were also excluded. An effect size (ES) and associated standard error (SE) was derived for each included outcome. For continuous variables the measure of effect was the standardized mean difference (SMD) in post-test scores; for binary variables it was the (post-test) risk difference. For some outcomes the effect and/or SE was estimated from reported statistics such as t-, chi-square, or p-values.[14] Some studies adjusted their analysis for clustered samples, others did not. We did not attempt to adjust for clustering where the original analysis had not. A positive effect indicated a result in favour of nurse supplements; a negative effect favoured usual care (control condition).

Meta-analysis was applied to outcomes for which there was adequate reporting of intervention effects from at least three RCTs, as meta-analysis would not add substantial value to semi-quantitative examination when less than three RCTs were available. We excluded non-randomized studies from meta-analysis due to their inherent greater potential for bias. For each meta-analysis it was necessary to specify a single outcome for each study. Where outcomes for subgroups or subcomponents (e.g. subscale questionnaire) of

outcomes were available alongside an overall effect, we used the overall effect. In absence of an overall effect we pooled the subgroup or subcomponent data to derive an overall effect. Where a study contributed multiple outcomes to an outcome group we used the median effect size and median standard error.[15] We applied a standard Fixed Effects (FE) model with studies weighted by sample size. We also conducted tests for heterogeneity of effect size between studies using the Q-statistic. Many outcome categories were dominated by one or two very large studies, therefore as a sensitivity analysis we conducted a uniformly weighted analysis.[16] Instances where the conclusion from this unweighted analysis differed from the weighted analysis are reported in the text. The FE model provides an accurate estimate of the average effect (and confidence interval) within the included studies even when the number of studies is small[17] but does not provide a statistical basis for generalizing beyond the studies in hand.[18]

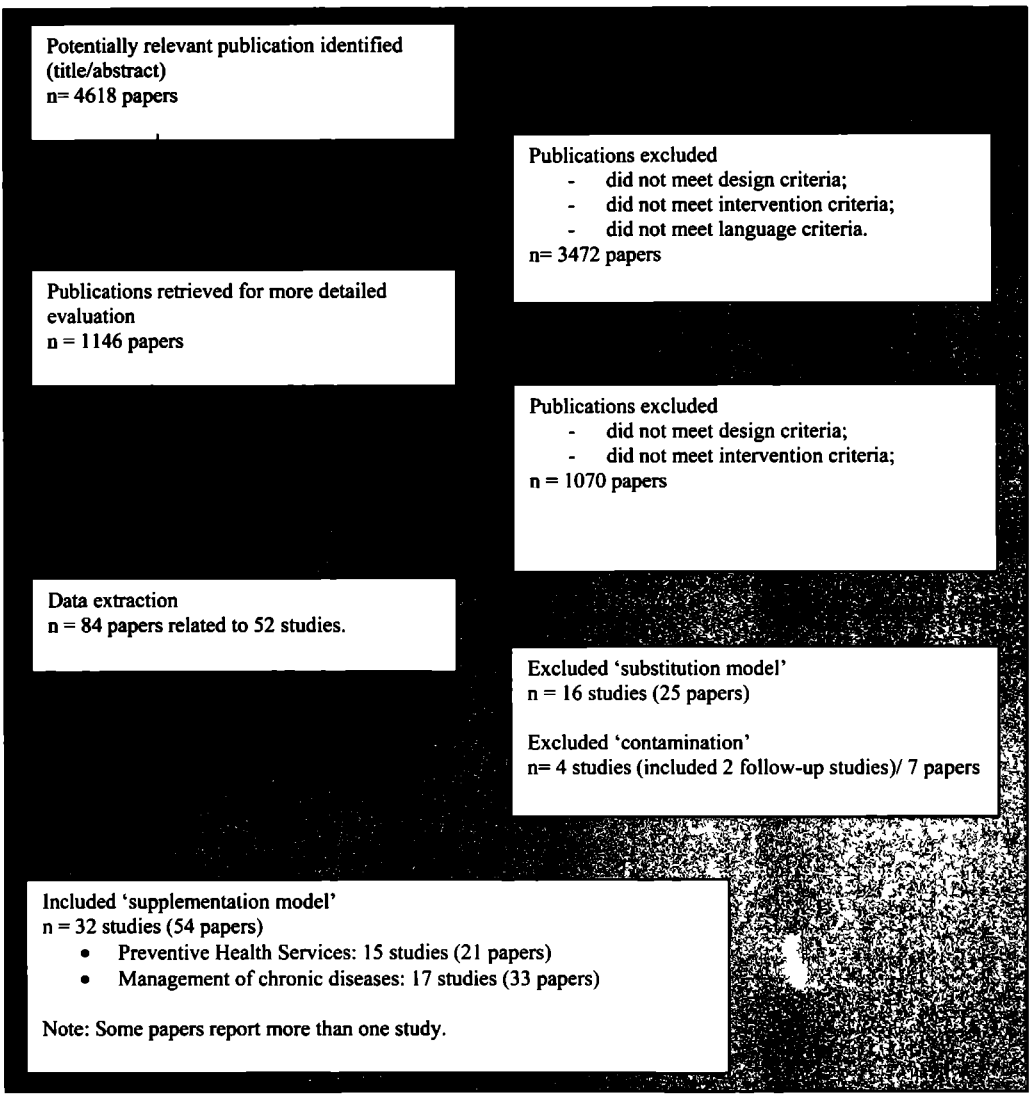
All outcomes, both those included in meta-analysis and those not amenable to meta-analysis, were subjected to semi-quantitative evidence synthesis. Semi-quantitative synthesis included: (a) all studies regardless of research design; (b) effects for subgroups or subcomponents of outcomes only in the absence of an overall effect, or when the study was designed to measure subgroup or subcomponent differences; (c) outcomes for which an effect and statistical significance could be calculated; and (d) outcomes for which an effect not be computed but for which statistical significance was known. The tables report effect sizes and significance (alpha 5%, two-tailed) only; 95% Confidence Intervals are available from the authors.

Results

Trial flow

We identified 4618 potentially relevant articles (Figure 2). Exclusion of those not meeting design, intervention, and language criteria left 84 articles relating to 52 studies. Sixteen were excluded as they evaluated nurses working as physician substitutes.[9] Four studies (7 papers)[19-25] were excluded as contamination had occurred between the control and intervention groups; two of these[22-25] reported on long-term follow-up of studies included in this review. Fifty-four articles relating to 32 studies met our inclusion criteria. Of these, 25 were RCTs and seven CBAs. Fifteen studies (21 articles) dealt with preventive health services[26-46] and 17 (33 articles) with chronic disease management.[47-79] The text below cites only the principal reference in respect of each study, except for papers reporting economic results which are seperately cited.

Figure 2. Flow diagram of identification of trials for inclusion



Preventive health services

Table 1 (appendix) describes the characteristics of included studies (n=15). The majority (n=9) were carried out in the UK;[27,29,32,35,36,41,45] five were located in the US;[26,31,33,34,44] and one was situated in Canada.[46] The role of the nurse varied across studies and included health assessments for elderly people or unselected adults; screening for cardiovascular risk factors, cancer or hazardous drinking; and facilitating service uptake in vulnerable groups such as mothers with young children or depressed patients. The number of nurses varied

from 1 to 27, but was not reported in four studies. In most studies the nurse worked for more than one doctor. The number of doctors varied from 1 to 182, but was not given in four studies. The number of patients varied from 94 to 15405. The follow-up period varied from 3 months[26,45] to 4 years,[35] but was one year or less in most studies.[26,31,33,34,36,44-46]

The methodological quality was mixed. Of 15 studies, 6 studies had concealed treatment allocation (RCT)[32,34,35] or had comparable primary outcomes at baseline (CBA);[26,29,31] 5 had blinded outcome assessment;[27,32-34,36] and 12 followed-up 80% or more of patients.[26,27, 32-34,36,41,44-46] In total, six studies met at least 3 of our 4 quality criteria.[27,32-34,36]

Patient outcomes

Meta-analysis was possible for two outcome groups: mortality and adherence to treatment. Nurse supplementation was associated with a significant reduction in mortality (ES, 0.141; 95%CI, 0.049 to 0.234; p=0.003) across three studies, all dealing with elderly patients (Figure 3). There was considerable heterogeneity between studies regarding the effect on adherence to treatment (Q=31.9, df=3, p<0.001) but the pooled effect was not significant (ES, 0.068; 95%CI, -0.064 to 0.201) (Figure 4). Three of these four studies dealt with cancer screening.

Figure 3. Preventive services: Fixed Effect meta-analysis of impact on mortality

				95% CI		
Study	Year	Effect	SE	Lower	Upper	Weight
Vetter(A)[27]	1984	0 015	0.085	-0 153	0.182	0 305
Vetter(B)[27]	1984	0 232	0 083	0 069	0.394	0.322
Vetter[35]	1992	0.167	0.077	0.016	0.319	0 374

	95% CI		Asymptotic		
Pooled Effect	Lower	Upper	Z-value	P-value	Studies
0 141	0.049	0.234	3 00	0 003	3

Test for heterogeneity Q= 3 5 on 2 degrees of freedom (p= 0 174)

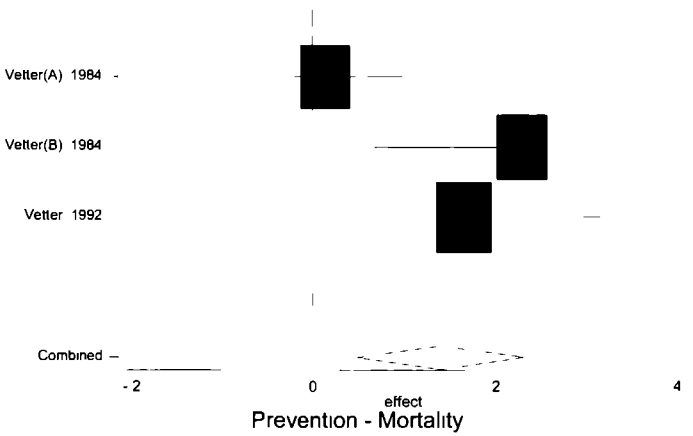


Figure 4. Preventive services: Fixed Effect meta-analysis of impact on treatment adherence

				95% CI		
Study	Year	Effect	SE	Lower	Upper	Weight
Cargill[33]	1991	1.206	0.225	0 766	1 646	0.090
Goldberg[34]	1991	-0.220	0.604	-1.404	0 964	0 013
Sharp(A)[45]	1996	0.102	0.104	-0.102	0.307	0.418
Sharp(B)[45]	1996	-0.168	0 098	-0.359	0 023	0 479

	95% CI		Asymptotic		
Pooled Effect	Lower	Upper	Z-value	P-value	Studies
0.068	-0.064	0.201	1 01	0 310	4

Test for heterogeneity Q= 31 9 on 3 degrees of freedom (p= 0.000)

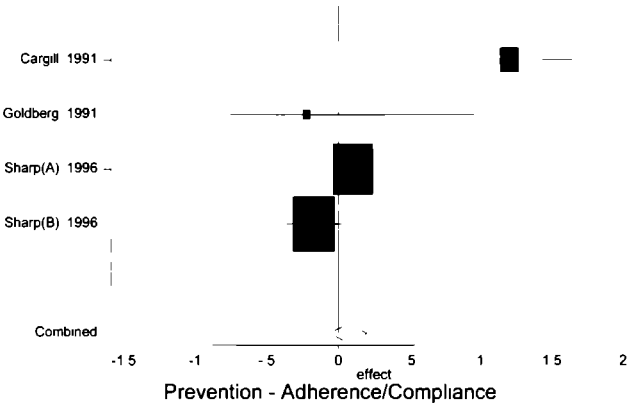


Table 2 provides the evidence summary chart for patient outcomes. Nurse supplementation was associated with better detection of cardiovascular risk factors (17 of 21 outcomes favoured nurses; none favoured doctors), although the results relate to only two studies of which one was low quality. Patients receiving nurse services were more likely to be diagnosed with a cardiovascular disease[36] or falls and fractures[35] (4 of 9 outcomes favoured nurse; none favoured doctors), but these results also relate to only two studies of which one was low quality. There was no apparent effect of nurse supplementation on other patient outcomes, such as patient health, preference or knowledge, but only five studies examined these outcomes of which three were low quality. None of the included studies reported patient satisfaction.

Table 2. Preventive services: Evidence summary chart for patient outcomes (n=12 studies; 47 outcomes)

	Quality rating	Meta-analyzed	Favours control	No significant difference	Favours intervention
Mortality (3 outcomes)					
Vetter(A), 1984[27]	3	Yes		0	
Vetter(B), 1984[27]	3	Yes			2
Vetter, 1992[35]	2	Yes			2
Risk factors (21 outcomes)					
BFHS, 1984[36(1)]	3	No		0_b 1_a 1_b 1_b	1_a 1_a 1_a 1_b 3_a 3_a 3_b 3_b $\#_a$ $\#_b$
Muir, 1995[41]	2	No			1 1 1 1 2 3 3
Diagnosed health status (9 outcomes)					
BFHS, 1984[36(1)]	3	No		0_a 0_b 1_a 1_b	1_a 1_b 2_a 2_b
Vetter, 1992[35]	2	No		0	
Patient reported health (7 outcomes)					
Vetter(A), 1984[27]	3	No		1 1 1	
Vetter(B), 1984[27]	3	No		-1 1 2	
Klerman, 1987[31]	1	No			6
Treatment adherence (4 outcomes)					
Goldberg, 1991[34]	4	Yes		-2	
Cargill, 1991[33]	3	Yes			12
Sharp(A), 1996[45]	2	Yes		1	
Sharp(B), 1996[45]	2	Yes		-2	
Preference (2 outcomes)					
Thompson, 1982[26]	2	No		1 1	
Other, knowledge (1 outcome)					
Margolis, 1996[44]	2	No		2	

Figures in cells are effect sizes x 10, eg 2=0 2, #=actual value not known
(1) $_a$Male subgroup, $_b$Female subgroup

Process of care

No process of care outcomes were amenable to meta-analysis. Table 3 provides the evidence summary chart for process of care measures. The findings suggested that nurse supplementation was associated with better record keeping (13 of 17 outcomes favoured nurse; none favoured doctors), better patient management (3 of 3 outcomes favoured nurse), and improved access to services for mothers of young children (2 of 4 outcomes favoured nurse; none favoured doctors). Effect sizes varied widely (respectively, ES, -0.09 to 0.83; ES, 0.51 to 0.93; and ES, 0.48 to 0.99). These outcomes were only reported in four studies, and all but one were low quality. None reported doctors' workload.

Table 3. Preventive services: Evidence summary chart for process of care (4 studies/ 24 outcomes)

	Quality rating	Meta-analysed	Favours control	No significant difference	Favours intervention
Record keeping (17 outcomes)					
Robson, 1989[32] (1)	4	No			3_a 3_a 6 6_a 6_a 6_a 8_a
Thompson, 1982[26] (1)	2	No		-1_a 0_a 0_a 1_a	2 2_a 2_a
Fullard, 1987[29]	1	No			2 6 6
Management (3 outcomes)					
Margolis, 1996[44]	2	No			9
Thompson, 1982[26]	2	No			5 7
Service Access (4 outcomes)					
Margolis, 1996[44]	2	No		5 5	6 10

Figures in cells are effect sizes x 10, eg 2=0.2
(1) $_a$subtest

Resource utilization and cost-effectiveness

Meta-analysis was possible for one outcome group; service use, relating to the uptake of "specialist" services such as alcohol counselling, prenatal visits, and services provided by district nurses and home helps that were available to both intervention and control patients (Figure 5). Meta-analysis showed nurse supplementation was associated with a significant increase in the use of specialist services (ES, 0.231; 95% CI, 0.124 to 0.338; p<0.001), but studies varied significantly in the size of effect (Q=14.0, df=3; p=0.003).

Figure 5. Preventive services: Fixed Effect meta-analysis of impact service use

				95% CI		
Study	Year	Effect	SE	Lower	Upper	Weight
Goldberg[34]	1991	0.404	0.104	0.199	0.609	0 273
Margolis[44]	1996	0.810	0.266	0 289	1.331	0 042
Vetter(A)[27]	1984	-0 009	0 095	-0.195	0.176	0 332
Vetter(B)[27]	1984	0.254	0.092	0.075	0.434	0 354

	95% CI		Asymptotic		
Pooled Effect	Lower	Upper	Z-value	P-value	Studies
0.231	0.124	0.338	4.23	0 000	4

Test for heterogeneity: Q= 14 0 on 3 degrees of freedom (p= 0 003)

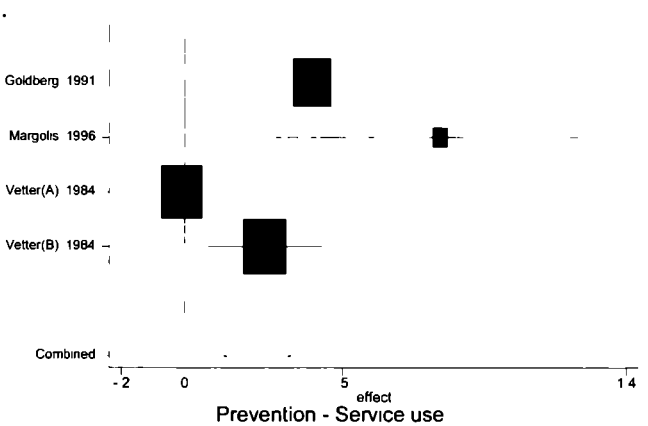


Table 4 provides the evidence summary chart for resource utilization. One low quality study,[31] not included in meta-analysis, found no difference in consultation rates between intervention and control practice. There was no appreciable impact of nurse supplementation on consultation rates in either high or low quality studies. Rates of testing and investigation were found to be higher for nurses in one high quality study and lower in one low quality study. None measured consultation length or prescribing rate.

Table 4. Preventive services: Evidence summary chart for resource utilization (7 studies/21 outcomes)

	Quality rating	Meta-analysed	Favours control	No significant difference	Favours intervention
Number of consultations (19 outcomes)					
Goldberg, 1991[34]	4	Yes			4
Vetter(A), 1984[27]	3	Yes		0 0 # # # #	
Vetter(B), 1984[27]	3	Yes		# #	2 3 # #
Margolis, 1996[44]	2	Yes			8
Klerman, 1987[31 (1)]	1	No		-3 -3_a -1_a -1_a 1	
Number of Tests & Investigation (2 outcomes)					
Cargill, 1991[33]	3	No			8
Thompson, 1982[26]	2	No	-4		

Figures in cells are effect sizes x 10, eg 2=0.2; #=actual value not known
(1): $_a$subset of all visits

Cost (effectiveness) was assessed in three studies.[26,38,39,43] Thompson et al[26] showed that "controllable" costs were lower in nurse-doctor teams than doctor only teams, but overall health care utilization rates and costs were slightly higher with nurse supplementation at three months post intervention. Two other studies[38,43] suggested that the marginal benefits to patients of cardiovascular risk screening by nurses did not outweigh the costs. Such screening programmes were said to be justifiable only if reductions in risk factors persisted for 5 to 10 years.[39]

Chronic disease management

Study characteristics

Table 5 (appendix) describes the characteristics of included studies (n=17). The majority of studies (n=8) were carried out in the UK;[60,69-71,73,76,77] three were located in the US;[61,65,72] two in the Netherlands;[52,79] two in Australia;[64] one in Sweden;[54] and one in Canada.[49] The role of the nurse varied widely and included the management of patients with cardiovascular disease, hypertension and hyperlipidemia; mental health problems; low back pain; hearing and ear problems; and epilepsy. In two studies nurses were involved in the management of more than one chronic disease. The number of nurses studied varied from 1 to 28, but was not reported in the majority of studies. The number of doctors was generally not reported. With the exception of one study[65] all studies reported the number of practices and this varied from 2 to 34. The number of patients varied from 61 to 1793. The

study period varied from three weeks[70] to five years[54], but was under one year in most studies.[52,60,64,65,69-73,76]

Study quality was mixed. Of 17 studies, five concealed treatment allocation (RCT)[61,73,79] or had comparable primary outcomes at baseline (CBA);[49,72] eight had blinded outcome assessment;[52,54,61,64,71,73,77] and 13 followed-up 80% or more of patients.[52,54,61,64,69-73,76,77] In total six studies fullfilled 3 of 4 quality critria.[61,64,71,73,77]

Patient outcomes

Meta-analysis was possible for two outcome groups: risk factors and self-reported health. The findings suggest that nurse supplementation was associated with a significant reduction in cardiovasucular risk factors (ES, 0.175; 95% CI, 0.100 to 0.250; p<0.001), though with highly significant heterogeneity between studies (Q=22.3, df=6; p=0.001) (Figure 6). Furthermore, nurse supplementation was associated with better patient reported health (ES, 0.107; 95% CI, 0.015 to 0.199; p=0.022) (Figure 7). Unweighted models provided a similar result for risk factors, but self-reported health was no longer significant (ES, 0.058; 95% CI, -0.138 to 0.254; p=0.562).

Figure 6. Chronic disease management: Fixed Effect meta-analysis of impact on risk factors

				95% CI		
Study	Year	Effect	SE	Lower	Upper	Weight
Van Ree[52]	1985	0.485	0.098	0.293	0.678	0 151
Campbell[73]	1998	0.212	0.086	0.045	0.380	0 199
Cupples[61]	1994	-0.006	0.091	-0 184	0.172	0 177
Moher[77]	2001	0.024	0.069	-0.112	0.160	0.303
Eckerlund[54]	1986	0.399	0.121	0.162	0.636	0.100
Woolard(A)[64]	1995	0.171	0.206	-0 233	0.575	0.034
Woolard(B)[64]	1995	0 203	0.200	-0.190	0.595	0.036

	95% CI		Asymptotic		
Pooled Effect	Lower	Upper	Z-value	P-value	Studies
0.175	0.1	0.25	4.58	0	7

Test for heterogeneity. Q= 22 3 on 6 degrees of freedom (p= 0.001)

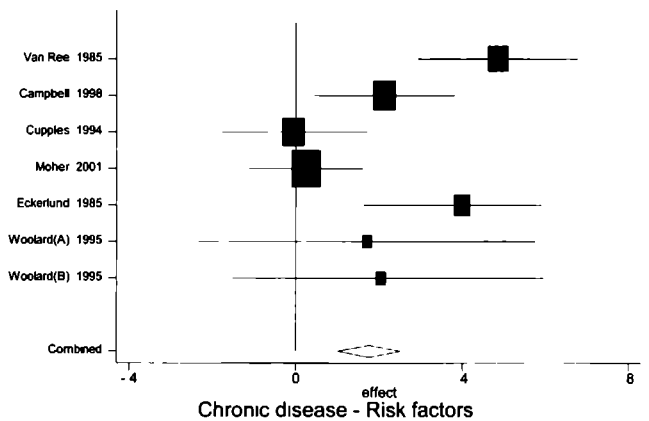


Figure 7. Chronic disease management: Fixed Effect meta-analyis of impact on patient reported health

Study	Year	Effect	SE	95% CI Lower	Upper	Weight
Campbell[73]	1998	0.126	0.061	0.010	0.248	0.601
Mynors[71]	1997	0.300	0.290	-0.268	0.867	0.026
Cupples[61]	1994	0.100	0.081	-0.059	0.257	0.339
Wilkinson[60]	1993	-0.293	0.256	-0.795	0.209	0.034

Pooled Effect	95% CI Lower	Upper	Asymptotic Z-value	P-value	Studies
0.107	0.015	0.199	2.29	0.022	4

Test for heterogeneity: Q= 3.0 on 3 degrees of freedom (p= 0.393)

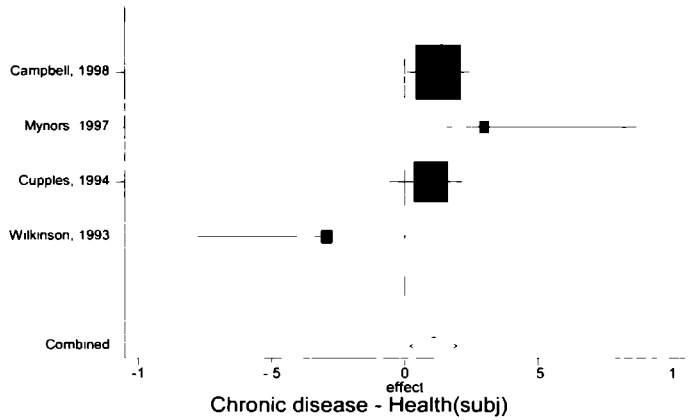


Table 6 provides the evidence summary chart for patient outcomes. The semi-quantitative analysis supports the meta-analyses in suggesting that nurse supplementation may be associated with marginally better risk factor management and self-reported health. This appeared true for both low and high quality studies. Mortality was no different with nurse supplementation in the single study[61] which assessed this outcome. Patient satisfaction was higher with nurse supplementation (14 of 15 outcomes), but only one of the six studies which assessed this outcome was high quality. Effect sizes ranged from 0.25 to 0.71, but was unknown for 8 of 15 outcomes. There were too few data, all drawn from low quality studies, to assess the impact of nurse supplementation on other aspects of care.

Table 6. Chronic disease management: Evidence summary chart for patient outcomes (n= 16 studies; 112 outcomes)

	Quality rating	Meta-analysed	Favours control	No significant difference	Favours intervention
Mortality (1 outcome)					
Cupples, 1994[61]	4	No		1	
Risk factors (36 outcomes)					
Campbell, 1998[73]	4	Yes		-1	2 3
Cupples, 1994[61]	4	Yes		-2 -1 0 0 1 1 1	
Moher, 2001[77]	3	Yes		0 0 0	4 9
Woolard (A), 1995[64]	3	Yes		1 2 2 2 3	
Woolard (B), 1995[64]	3	Yes		1 1 2 3 3	
Van Ree, 1985[52 (1)]	2	Yes		1	3 4_b 7 7_a 7_a 9_b
Eckerlund, 1985[54]	2	Yes			4 4
Pine, 1997[72]	2	No		-1 #	
Diagnosed Health (2 outcomes)					
Mann (A), 1998[76]	2	No		-1	
Mann (B), 1998[76]	2	No		-1	
Patient reported health (46 outcomes)					
Campbell, 1998[73]	4	Yes		0 1 1 1 1	1 1 1 2 2 2 2
Cupples, 1994[61]	4	Yes		0 1 1 1 1 1 1 #	
Mynors, 1997[71]	3	Yes		3 3 # # # #	6
Cherkin, 1996[65]	2	No		# # # # # # #	
Fall, 1997[70]	1	No		# # # # # # # # # # #	
Wilkinson, 1993[60]	1	Yes		-3	
Treatment adherence (2 outcomes)					
Cherkin, 1996[65]	2	No			#
Wilkinson, 1993[60]	1	No		3	
Satisfaction (15 outcomes)					
Mynors, 1997[71]	3	No			7 7
Cherkin, 1996[65]	2	No		#	# #
Eckerlund, 1985[54 (2)]	2	No			3_a 3_a 4 5_a
Ridsdale, 1997[69]	2	No			
Batchelor, 1975[49]	1	No			# # # # #
Fall, 1997[70]	1	No			3
Preference (4 outcomes)					
Eckerlund, 1985[54]	2	No		-2 2	4 8
Other (6 outcomes)					
Cherkin, 1996[65]	2	No		#	#
Eckerlund, 1985[54 (3)]	2	No		-1_a	8_b
Batchelor, 1975[49]	1	No		2	
Wilkinson, 1993[60]	1	No		3	

Figures in cells are effect sizes x 10, eg 2=0 2, #=actual value not known

(1) $_a$advice subgroup, $_b$medicine subgroup

(2) $_a$satisfied with information subgroup

(3) $_a$patient-physician continuity subgroup, $_b$patient-nurse continuity subgroup

Process of care

Meta-analysis was possible for one outcome group: clinical management (Figure 8). This showed that the quality of care in a diverse range of chronic diseases was higher with nurse supplementation (ES, 0.680; 95% CI, 0.594 to 0.767; p<0.001), but with considerable differences in effect size between studies (Q=41.6, df=3; P<0.001).

Figure 8. Chronic disease management: Fixed Effect meta-analysis of impact on clinical management

Study	Year	Effect	SE	95% CI Lower	95% CI Upper	Weight
Campbell[73]	1998	0 645	0.113	0 423	0.866	0.152
Moher[77]	2001	0.744	0 057	0 631	0 856	0 588
Eckerlund[54]	1985	0.089	0.115	-0.136	0 314	0 147
Ridsdale[69]	1997	1.165	0 131	0 909	1 421	0.114

Pooled Est	95% CI Lower	95% CI Upper	Asymptotic Z-value	Asymptotic P-value	Studies
0.680	0.594	0.767	15.46	0	4

Test for heterogeneity: Q= 41 6 on 3 degrees of freedom (p= 0.000)

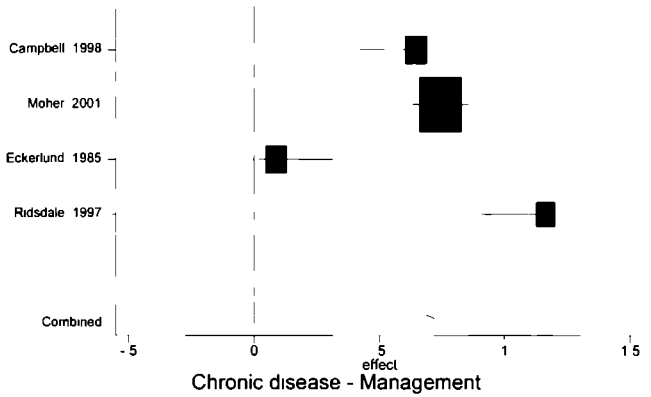


Table 7 provides the evidence summary chart for process of care measures. There were too few data, all drawn from low quality studies, to assess impacts on record keeping, health service access, and doctors' workload.

Table 7. Chronic disease management: Evidence summary chart for process of care (n= 5 studies; 24 outcomes).

	Quality rating	Meta-analysed	Favours control	No significant difference	Favours intervention
Record keeping (5 outcomes)					
Ridsdale, 1997[69]	2	No			5 13 14 16 17
Management (13 outcomes)					
Campbell, 1998[73]	4	Yes			6 6 9 #
Moher, 2001[77 (1)]	3	Yes			3_a 5_a 5_a 7
Eckerlund, 1985[54]	2	Yes		1 1	4 #
Ridsdale, 1997[69]	2	Yes			12
Service Access (2 outcomes)					
Eckerlund, 1985[54]	2	No		#	#
Subjective Workload (4 outcomes)					
Laurant, 2004[79]	2	No		-2 0 0 2	

Figures in cells are effect sizes x 10, eg 2=0.2; #=actual value not known
(1): $_a$subcomponent

Resource utilization and cost-effectiveness

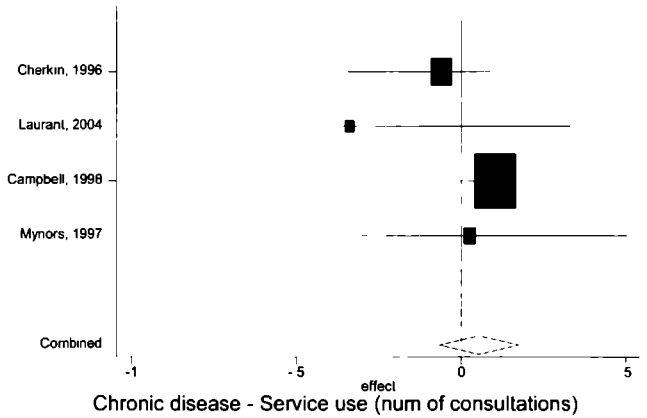
Meta-analysis was possible for two outcome groups: number of consultations (figure 9) and number of prescriptions (figure 10). The findings showed no significant differences between nurse supplementation and physician only care in a diverse range of chronic diseases (respectively, ES, 0.053; 95%CI – 0.07 to 0.173; p=0.382; ES, 0.071; 95%CI, -0.012 to 0.154; p=0.092).

Figure 9. Chronic disease management: Fixed Effect meta-analysis of impact on consultation rate

				95% CI		
Study	Year	Effect	SE	Lower	Upper	Weight
Cherkin[65]	1996	-0.062	0.144	-0.345	0.221	0.179
Laurant[79]	2004	-0.339	0.342	-1.009	0.331	0.032
Campbell[73]	1998	0.102	0.072	-0.039	0.242	0.726
Mynors[71]	1997	0.026	0.244	-0.453	0.504	0.063

	95% CI		Asymptotic		
Pooled Effect	Lower	Upper	Z-value	P-value	Studies
0.053	-0.07	0.173	0.87	0.382	4

Test for heterogeneity: Q= 2.4 on 3 degrees of freedom (p= 0.489)



Chronic disease - Service use (num of consultations)

Figure 10. Chronic disease management: Fixed Effect meta-analysis of impact on prescriptions

Study	Year	Effect	SE	95% CI Lower	95% CI Upper	Weight
Moher[77]	2001	0.041	0.057	-0.072	0.153	0.542
Cupples[61]	1994	0.187	0.091	-0.365	-0.009	0.217
Mann(A)[76]	1998	0.285	0.159	-0.027	0.597	0.070
Mann(B)[76]	1998	-0.066	0.102	-0.267	0.134	0.171

Pooled Effect	95% CI Lower	95% CI Upper	Asymptotic Z-value	Asymptotic P-value	Studies
0.071	-0.012	0.154	1.69	0.092	4

Test for heterogeneity: Q= 5.5 on 3 degrees of freedom (p= 0.137)

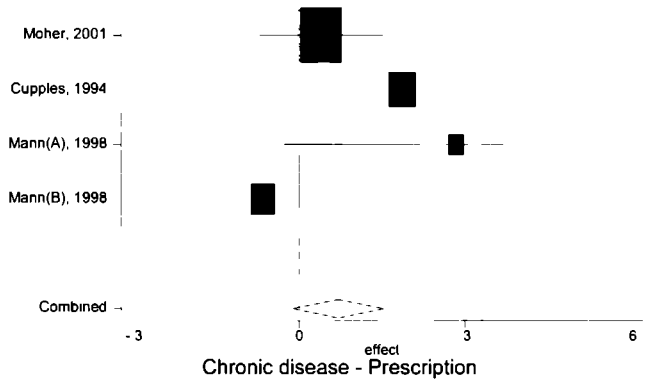


Table 8 provides the evidence summary chart for resource utilization measures. The findings support those of the meta-analysis in suggesting that there was no difference between nurse supplementation and doctor only care in patient consultation rates. Effect sizes, however, varied from significantly favouring the doctor, to significantly favouring nurse supplementation, implying that context may be important, although six out of eight studies were low quality. Length of consultation was examined in only two studies, one of which was high quality, and neither found a significant difference between nurse supplementation and doctor only care. Most studies were low quality; those that were not were more likely to show higher resource utilization with nurse supplementation.[61,73,77] None of the included studies reported on number of tests and investigations.

Cost was assessed in four studies.[51,54,70,71] Three found costs were lower with nurse supplementation than doctor only care.[51,54,70] The fourth study[71] found that overall costs were significantly higher with nurse supplementation due to the added cost of the nurse-provided initial treatment (problem-solving therapy).

Table 8. Chronic disease management: Evidence summary chart for resource utilisation (n= 11 studies; 31 outcomes)

	Quality rating	Meta-analysed	Favours control	No significant difference	Favours intervention
Number of consultations (22 outcomes)					
Campbell, 1998[73]	4	Yes		0	2
Mynors, 1997[71]	3	Yes		0	
Cherkin, 1996[65]	2	Yes		-1	
Laurant, 2004[79](1)	2	Yes		-4_a -4_a -4_a -3_a -3_a -3_a -1_a 1_b 1_b 2_b 2_b 2_b 2_b 3_b	
Mann(A), 1998[76]	2	No		#	
Mann(B), 1998[76]	2	No		#	
Fall, 1997[70]	1	No	-4		
Wilkinson, 1993[60]	1	No		#	
Duration of consultation (2 outcomes)					
Campbell, 1998[73]	4	No		-1	
Eckerlund, 1985[54]	2	No		#	
Prescription (7 outcomes)					
Cupples, 1994[61]	4	Yes			2
Moher, 2001[77]	3	Yes		0 1	#
Mann(A), 1998[76]	2	Yes		3	
Mann(B), 1998[76]	2	Yes		-1	
Wilkinson, 1993[60]	1	No		#	

Figures in cells are effect sizes x 10, eg 2=0 2, #=actual value not known
(1). $_a$surgery hours subgroup, $_b$out-of-hours subgroup

Discussion

The findings suggest that adding nurses to doctor teams in primary care may improve the quality of care and health outcomes for patients. The impact on resource utilization and effectiveness was uncertain.

In the area of preventive health care, the evidence was strongest in suggesting that nurse supplementation improved the detection and recording of risk factors. The benefits in terms of improved health outcomes for patients were less marked, with the exception of studies in elderly patients where mortality was significantly reduced. Patient compliance with interventions to reduce risk was not significantly improved by nurse supplementation. Patient satisfaction was not assessed. Resource use appeared higher, although in many instances this was the intended outcome of nurse interventions designed to promote the uptake of specialist services. Overall cost-effectiveness was evaluated only in respect of cardiovascular risk factor screening, where the high cost of nurse supplementation was found not to justify the small gains in health for patients.[39,40,44] This is unsurprising given that a previous Cochrane review of health screening in well adults showed also that screening is associated with significant improvements in risk factor detection but minimal gains in health.[80] The cost-effectiveness of nurse supplementation for other types of preventive care has not been assessed, but will be more favorable where the interventions nurses are asked to deliver have a greater potential to improve health.

In the area of chronic disease management, nurse supplementation was associated with improved clinical management, leading to improved risk factor control, better self-reported health and higher patient satisfaction across a wide range of clinical conditions. This should in turn lead to slower disease progression and reduced mortality, although there is insufficient evidence to demonstrate whether these gains are achieved in practice given the short duration of follow-up in most studies. Patient consultation rates and prescription rates did not appear to be increased by nurse supplementation, but there was a general paucity of information regarding resource utilization. Overall cost-effectiveness varied across the few studies in which it was measured. This is unsurprising given that both effectiveness and cost are likely to depend on the specific context of each intervention. Variations in the effectiveness of nurse supplementation will depend on which aspects of quality of care were improved by nurses, by how much, and with what effect on patient outcomes. Variations in cost will depend on differences in salary and resource utilisation between nurses and alternative providers such as doctors.

For several areas of outcomes results varied significantly from one study to another, implying that the benefits gained from nurse supplementation depend upon the particular context within which supplementation is implemented. Information on potential barriers and facilitators of implementation was, however, lacking in most studies, including information about nurses' levels of qualification and experience, and their degree of autonomy from physicians. There was no agreement as to the level of training required for nurses to undertake the roles covered by this review and no consistency in the use of job titles such as practice nurse or nurse practitioner.[81] Other studies have shown a 'learning effect'[78,82] whereby nurse performance improves with experience. All studies included in this review adopted the position that the nurses they investigated were competent to carry out their assigned role – and the evidence supports that assumption. Inadequate and inconsistent reporting of the degree of clinical autonomy of nurse supplements meant we could not assess the impact of this on outcomes. Additional research is therefore needed to investigate appropriate levels of training, experience and autonomy for nurses working in particular clinical roles.

Methodologic considerations

Our search was designed to maximize sensitivity (detection of relevant research) at the expense of specificity (excluding irrelevant research). Even so, relevant research may have been missed, particularly in the grey literature that we did not search.[83] Publication bias may have favoured studies finding a positive effect of nurse supplementation on outcomes.[84] We were unable to assess this possibility by means of funnel plots as there were too few studies.

Study quality may influence outcomes, but the effects we observed in high quality studies were generally mirrored by those in low quality studies. Although most studies included only small numbers of nurses, few considered the potential for variation in outcomes by practitioner. This may have led to over-precision in the estimates of differences between nurse supplementation and physician only care.

Our conclusions are based on pooled outcomes within the broad categories of preventive care and chronic disease management. If the effect of nurse supplemention on outcomes differs between services within these categories, these differences will have been masked. Cost-effectiveness, for example, is likely to depend on the specific nature and context of each intervention. The studies available, however, would not support a finer-grained level of quantitative analysis. We have attended to this limitation by reporting which effects appeared to be associated with a particular nursing role and which appeared common to the wider range of nursing roles within a particular category of care. The strength of our analysis lies in its ability to detect the most common effects of nurse supplementation on primary care provision; effects that are likely to ocurr irrespective of the precise clinical focus of the nurse's work. Our finding that nurse supplementation improved quality in the delivery of both preventive health care and chronic disease management meets this criteron.

Conclusion

Nurse supplementation can produce better health outcomes for patients if the treatments delivered by nurses are efficacious (improve health) and nurses improve delivery of those treatments (improve quality of care). Our findings suggest that adding nurses to doctor teams generally improved the quality of care delivery. Cost-effectiveness will therefore depend on how much extra 'health' accrues for each incremental gain in 'quality' and the cost of achieving this by nurse supplementation compared to other means (e.g. doctor only care). These apects of effectiveness and cost have been poorly addressed by existing research, are likely to vary with the specific context of care, and require closer attention in future research.

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Table 1. Preventive services; characteristics of included studies (n=15 studies)

Source	Design, quality rating[a]	Participants	Clinical domain	Intervention condition	Control condition
Robson[32]	RCT; 4	maximum 3206 patients (range 30-64 years); 1 practice nurse; 5 physicians; 1 practice	Health evaluation	Risk factors were ascertained and followed up by the nurse and physician, supported by a computer system.	Usual care.
Thompson[26]	CBA, 2	12756 patients (39% male; mean 42-47 years) 2 nurse practitioners; 10 physicians; 2 practices	Health evaluation	Adult patients were offered a periodic health evaluation by a nurse practitioner.	Usual care.
Vetter(A)[27 28]	RCT; 3	658 patients (70 years and older); 1 health visitor, 4 physicians; 1 practice	Health evaluation (elderly)	Elderly people (in Powys) received an unsolicited visit by a health visitor once a year. Any necessary follow up was offered.	Usual care
Vetter(B)[27 28]	RCT; 3	682 patients: (70 years and older); 1 health visitor; 6 physicians; 1 practice	Health evaluation (elderly)	Elderly people (in Gwent) received an unsolicited visit by a health visitor once a year. Any necessary follow-up was offered.	Usual care.
Vetter[35]	RCT; 2	674 patients (70 years older); 1 health visitor; 5 physicians; 1 practice	Risk falls & fracture (elderly)	Elderly people were visited at least once a year by a health visitor who assessed the risk of falls and fractures and intervened in those who had an obvious risk.	Usual care
BFHS[36 39]	RCT, 3	12472 patients (60% male; mean 48-42 years); 27 practice nurses, 104 to 182 physicians; 26 practices	Cardiovascular disease	Households were invited for screening by practice nurse, and were offered lifestyle counseling and follow-up.	Usual care.
Fullard[29 30]	CBA; 1	15405 patients (range 35-64 years); unknown number of practice nurses and, physicians, 6 practices	Cardiovascular disease	Patients were invited for a health check Practice nurse carried out the screening and gave health advice to patients. Practices were supported by a facilitator.	Usual care.
Muir[39-43]	RCT; 2	4121 patients (45% male; range 35-64 years); unknown number of practice nurses and physicians; 5 practices	Cardiovascular disease	Patients were offered health check by a nurse. If necessary follow-up examinations were planned, and all patients were offered an annual re-examination.	Usual care
Cargill[33]	RCT; 3	399 patients; (mean 63 years); at least 4 nurse clinicians and at least 24 physicians; number of practices unknown	Fecal Occult Blood Testing (FOBT)	Residents received a letter that nurses would be performing FOBT on eligble patients (50-75years of age) and advised them to refer all patients to the nurse. Nurses recruited patients to screening, patients received stamped envelope for return of test sample to nurses.	Residents received a letter reminding them that FOBT patient instruction sheets were located in each provider room along with stamped return envelopes.

Table 1. Preventive services; characteristics of included studies (n=15 studies)

Source	Design, quality rating[a]	Participants	Clinical domain	Intervention condition	Control condition
Sharp(A)[45]	RCT, 2	486 patients (0% male, range 50-64 years); unknown number of practice nurses; 27 physicians; unknown number of practices	Breast cancer	Women who did not attend breast cancer screening were offered a nurse home visit to discuss the issue and encourage uptake.	Women who did not attend breast cancer screening received a letter expressing concern and encouragement to take up screening.
Sharp(B)[45]	RCT; 2	475 patients: (0% male; range 50-64 years); unknown number of practice nurses, 27 physicians, unknown number of practices	Breast cancer	Women who did not attend breast cancer screening were offered a nurse home visit to discuss the issue of breast screening.	Women who did not attend breast cancer screening received a letter expressing concern and encouragement to take up screening.
Goldberg[34]	RCT; 4	1328 patients (49% male, mean 48-49 years); at least 3 clinic nurses; at least 36 physicians, 3 practices	Hazardous Alcohol consumption	Screening of alcohol intake. Patients with positive screens were asked if they wanted to talk to a alcohol counsellor. If yes, the nurse scheduled an appointment in the usual manner (group 1), or saw the alcohol counsellor before leaving the clinic (group 2).	Screening of alcohol intake Screening results were recorded, but no further actions were taken. Patient received usual care
McIntosh[46]	RCT; 2	119 patients (50% male; mean 31-32 years); 1 nurse practitioner; 1 physicians; 1 practice	Hazardous alcohol consumption	Patients were offered two sessions 2 weeks apart with the nurse practitioner in which stop drinking advice was given and a plan of action drawn up. In addition patients received a booklet and a sheet to record their drinking.	Patient received 5-minutes advice from their physician, and a handout reinforcing the advice
Klerman[31]	CBA; 1	128 patients (41% male; mean 27-28 years), 9 nurse practitioners, unknown number of physicians; 2 to 7 practices	Stress/distress	Patients with a $\geq$ 6 score on General Health Questionnaire were contacted by telephone and invited to make an appointment with the nurse practitioner for interpersonal counseling.	Usual care.
Margolis[44]	RCT, 2	94 patients (0% male; mean 21 years); 3 public health nurses; unknown number of physicians; 4 practices	Prenatal and child care	Women were encouraged to seek health care for their infants, and sent a reminder card to contact the practice after delivery. In addition they were visited evey 1 to 2 weeks by nurses to encourage uptake of prenatal and primary care services.	Usual care.

[a] An overall measure of quality (range 0-4 points); high quality rated 3-4 point and low quality rated 0-2 points

Table 5. Chronic disease management: characteristics of included studies (n=17 studies)

Source	Design, quality rating[a]	Participants	Clinical domain	Intervention condition	Control condition
Van Ree[52,53]	RCT; 2	1337 pattients (55% male); unknown number of practice nurses and physicians; 6 practices	Cardiovascular disease	All patients (20-50y of age) who visited their physician were invited for cardiovascular risk factor screening by a specially trained practice nurse. A cardiovascular risk profile was drawn and those with elevated risk were referred to their family physician. Patients at high risk (20% with highest risk scores) additionally received health education every 2 months from trained practice nurses.	Patients were invited for risk factor screening and referred as necessary to their family physician. Usual care then followed.
Campbell[73-75]	RCT; 4	1343 patients (58% male; mean 66 years); 28 nurses (practice nurses, district nurses and health visitors); unknown number of physicians; 19 practices	Cardiovascular disease	Patients were invited to attend secondary prevention clinics run by nurses. Behavioural change was negotiated and aspirin use was promoted Depending on clinical circumstances follow-up was offered (2 to 6 months).	Usual care.
Cupples[61 63]	RCT; 4	688 patients (59% male, mean 63 years); unknown number of health visitors and physicians; 18 practices	Cardiovascular disease	Patients received advice and health education, and were followed-up every 4 months.	Usual care.
Moher[77]	RCT; 3	1224 patients (69% male, mean 66 years); unknown number of practice nurses and physicians; 21 practices	Cardiovascular diseases	Patients received care from a nurse practitioner-physician team. Practices received summary with audit results. A facilitator gave ongoing support to the practice to develop and implement clincial guidelines.	Practice received anonymous summary with audit results but no facilitator. Patients received usual care.
Eckerlund[54-59]	RCT; 2	361 patients; unknown number of nurses and physicians; 10 practices	Hypertension	Nurse-led hypertension clinics supplemented usual care by doctors. First, known hypertensives were invited to the clinics and managed according to guidelines. Later, patients aged 40-65 years were screened and those found to be positive were invited to the clinics.	Usual care.
Woollard(A)[64]	RCT; 3	94 patients (53% male; mean 58 years); unknown number of nurse counsellors; 46 physicians; 13 practices	Hypertension	Patients had 6 face-to-face-appointments with a nurse and received educational manuals	Usual care.

Table 5. Chronic disease management: characteristics of included studies (n=17 studies)

Source	Design, quality rating[a]	Participants	Clinical domain	Intervention condition	Control condition
Woollard(B)[64]	RCT; 3	100 patients (53% male; mean 58 years); unknown number of nurse counsellors; 46 physicians; 13 practices	Hypertention	Patients had a single-face-to-face appointment with a nurse and 5 telephone counseling sessions with a nurse. Patients also received educational manuals.	Usual care.
Pine[72]	CBA; 2	122 patients (37% male, mean 53-54 years), 5 office nurses; 6 physicians; 1 practice	Cholesterol	Patients received advice and written information from physician and were then referred for individual counseling by a nurse. The nurse gave advice, written information and encouraged patients to atttend 4 additional counseling sessions during 1 year period.	Usual care
Mann(A)[76]	RCT, 2	256 patients; unknown number of practice nurses and physicians; 5 practices	Depression	GPs refered patients who they thought were depressed to a practice nurse. Practice nurses completed a standardized assessment of patients and reported the findings to GP.	Practice nurse completed a standardized assessment of patients, but findings were not reported to GP.
Mann(B)[76]	RCT; 2	419 patients; unknown number of practice nurses and physicians; 19 practice	Depression	GPs refered patients who they thought were depressed to practice nurses. Practice nurses completed a standardized assessment, reported findings to GP and offered follow-up sessions to monitor change in mental state, encourage compliance, provide education and facilitate social interventions as needed.	Practice nurse completed a standardized assessment of patients, but findings were not reported to GP and patients received no follow-up sessions.
Mynors[71]	RCT;3	70 patients (23% male; mean 28 years); 6 nurses (practice nurses; district nurses, health visitors); unknown number of physicians, 4 practices	Emotional disorders	Patients received problem-solving treatment by a nurse.	Usual care.
Wilkinson[60]	RCT; 1	61 patients (26% male; mean 46 years); 3 practice nurses, 12 physicians; 3 practices	Depression	Patients prescribed drugs saw the practice nurse 3 days later to discuss medication adherance and encourage uptake	Usual care.
Cherkin[65]	RCT; 2	299 patients: (52% male, mean 43 years) 6 practice nurses; unknown number of physicians and practices	Low back pain	Patients received educational advice and support from a practice nurse and in addition received a booklet	Usual care.

Table 5. Chronic disease management: characteristics of included studies (n=17 studies)

Source	Design, quality rating[a]	Participants	Clinical domain	Intervention condition	Control condition
Fall[70]	CBA; 1	790 patients: (53% male; 54 years (median)); unknown number of practice nurses and physicians; 17 practices	Hearing and ear problems	Patients were treated by practice nurses who supplemented usual care by physicians.	Usual care.
Ridsdale[66 69]	RCT; 2	251 patients (54% male, mean 51 years); unknown number of clinical nurse specialists; 37 physicians; 6 practices	Epilepsy	Patients were offered an appointment with a nurse in a neurology clinic.	Usual care.
Batchelor[47 51]	CBA; 1	1132 patients: (50% male); unknown number of nurse practitioners and physicians; 2 practices	General care (not specified)	Patients received care from a nurse practitioner - physician team.	Usual care
Laurant[78, 79]	RCT, 2	1793 referred patients (40% mael; 49% 65 years and older); 5 nurse practitioners; 48 physicians; 34 practices.	COPD/Asthma, dementia, cancer and other diseases	Patients (specific target groups) were referred to the nurse practitioner and offered care according to agreed guidelines Nurse care supplemented usual care by physicians.	Usual care.

[a] An overall measure of quality (range 0-4 points); high quality rated 3-4 point and low quality rated 0-2 points

Chapter 11

General discussion

Introduction

This thesis focussed on the *revision of professional roles* in primary care, in particular the shift of specific tasks of primary care doctors to nurses. In the mid nineties there was hardly any scientific evidence to support such a shift of tasks.[1] Nevertheless, in a variety of countries nurses were employed in family practice to take over care from the doctor or to offer a wider range of services in family practice. This shift in care was, amongst others, driven by rising demand for care, health workforce shortages and rising costs of health care services.[1,2] Although nurses' roles, responsibilities, and qualifications within and between countries are different, the overall aim of the shift in care is to improve health care effectiveness and efficiency,[3] and to reduce doctors' workload. This thesis contributes to the evidence on shift of specific tasks of primary care doctors to nurses.

We presented factors governing skill mix change (chapter 2) and compared the tasks, target groups and other characteristics of four different types of nurses who support the Dutch general practitioner (chapter 3). To study the effects of shifting tasks to nurses we conducted a cluster randomized trial (chapter 4 to 8) and the existing research was synthesized (chapter 9 and 10). Outcomes related to doctors' workload, quality of care, patients' health, preference and satisfaction, resource utilization and costs were included.

In this closing chapter the main findings of these studies are discussed, starting with 10 key messages. The main findings are categorized under 5 subheadings: a) nursing roles; b) doctors' workload; c) quality of care; d) patients' health, preference and satisfaction and its' determinants; and e) resource utilization and costs. Next, the most relevant methodological issues are reviewed. At the end some recommendations for future research and health policy are given.

Key messages

The results of the various studies lead to the following key messages:

Nursing roles

- Nurses are equipped to provide a wide range of primary care services, such as preventive health services, first contact and ongoing care, first contact for patients wanting urgent attention, management of minor illnesses, management of chronic diseases, et cetera. It is likely that nurses provide even a wider range of services than is represented in the current research literature.
- There is considerable variation between and within countries regarding nursing titles, definitions and training. Future research into effectiveness and efficiency should therefore report nurses' level of training/education and competencies for defined tasks and responsibilities.

Doctors' workload

- Contrary to general expactations, skill mix change does not necessary reduce doctors' workload. Although the evidence base is still small, we conclude that substitution has the potential to reduce workload, but only when doctors give up providing the types of care that have been delegated to nurses. Supplementation will not immediately reduce workload. Whether it does so in the longer term will depend on the target group (e.g. minor illnesses, chronic diseases) and nurses' tasks and responsibilities.

Quality of care

- Appropriately trained nurses can produce as high quality care as general practitioner. There is some evidence that the quality of care may be higher when nurses are involved in primary care services.

Patients' health, preference and satisfaction

- Patients are generally more satisfied with nurse-led care compared to doctor-led care. Despite this finding, patients generally prefered to see a doctor instead of a nurse. Patients believe nurses have an important role to play in routine care, education and guidance of patients and their relatives. Doctors should continue to play the leading role in medical aspects of care such as medical treatment, discussing physical complaints, and providing information about disease and prognosis.

Resource utilization and costs

- There is no evidence that the involvement of nurses leads inevitably to increases in the volume of resources used in health care, such as number of consultations, test and investigations and prescriptions. The impact of skill mix changes on volume of resources are mixed. Volume of resource use appeared to be determined by target group, tasks and responsibilities of nurses. Substitution has the potential to reduce costs, but whether it does so in practice will depend on local contextual factors. Supplementation may increase costs but has the potential to improve quality. Whether the gains in quality justify the added costs will depend on local contextual factors.
- Nurses tended to have longer consultations, which may explain higher levels of patient satisfaction
- The cost-effectiveness of both substitution and supplementation has rarely been the subject of research. Economic trials found mixed findings. The review on nurse' subsitution found no savings on costs. The review on nurse supplemementation found mixed results. It is therefore difficult to draw firm conclusions. Future research should aim to measure cost-effectiveness in terms of costs per quality adjusted life year.

Implications future research and policy

- In practice, doctors are supported by different types of non-medical professionals. Before advocating further proliferation of non-medical professionals, health policy should first

aim to provide clear job descriptions, in which tasks, responsibilities and qualifications are reported and regulated People should strive to attain the most effective mix of staff achievable within available resources
- Skill mix both determines, and is determined by, organizational systems and the wider health care economy The mix of skills that primary care professionals should have is therefore heavily dependent on context, and will vary from country to country Future developments should be supported by research evidence

These key messages are elaborated below

Discussion of the main findings

a Nursing roles all the same or different?

Both the qualitative study on four types of Dutch nursing roles (chapter 3) and the two systematic reviews (chapter 9 and 10) showed a wide variation in the range of care provided by different type of nurses, such as practice nurses, nurse practitioners, district nurses, nurse specialists, and health visitors We saw considerable overlap in services and target groups between the different types of nurses Furthermore, even, the roles of same type of nurses may vary widely This was also shown in other studies [e g 4 6] A background study by Merten (2006)[7] into the organization of diabetic care is illustrative to this point This study showed that general practitioners, medical specialists, nurse practitioners and diabetes specialist nurses all were involved in diabetic care Many of the tasks were performed by more then one professional, there was no clear demarcation between job descriptions Which professsional was involved in diabetic care seemed related to local arrangements and agreements

Nursing titles are used interchangeably in the literature [8 9] Advanced practice nurse is an umbrella term that covers a number of nursing roles, such as the role of "nurse specialist", "advanced practice nurse" and "nurse practitioner" [10] The International Council of Nurses (ICN)[11 12] defines the role of advanced practice nurses as *"A nurse practitioner/advanced practice nurse is a registered nurse who has acquired the expert knowledge base, complex decision-making skills and clinical competencies for expanded practice, the characteristics of which are shaped by the context and/or country in which she is credentialed to practice A Masters degree is recommended for entry level"* There is, however, considerable variation between and within countries regarding the training and the role of advanced practice nurses [13] There are, for example, more than 50 definitions or descriptions of nurse practitioners [14] The same is true for other nursing titles This makes it difficult to compare roles, level of education or competency of nurses using the same title either within or between countries [10 15] For clarity and interpretation of research evidendence it is,

therefore, argued that the focus should be on tasks, level of education, competencies and responsiblilities of the nurses providing primary care services instead of on nursing title or definition. A clear description of the nursing role enables the reader to translate the findings into their own context.

b. General practitioners' workload: more time off?

Contrary to the general expectation, we saw an increased number of consultations with general practitioners during surgery hours indicating an increased workload for general practitioners (chapter 5). Also no differences were found in subjective workload measures, although interviews with the general practitioners indicated that some doctors believed that nurses had lightened their burden of care. Within the substitution review (chapter 9) only one trial reported on objective workload. This study, [16] which looked at telephone triage by a nurse during out-of-hours, showed a reduction in workload on three outcome measures (i.e. number of telepone advice; of surgery visits; and of home visits). However, reduction of workload is only one aspect of skill mix changes, it should be considered alongside other outcomes. Richards et al (2002)[17] also looked at the effects of telephone triage by a nurse. Although he found a reduction in doctors' workload on the short-term, he also found adverse effects such as an increased numbers of routine appointments, out-of-hour consultations and attendances at accident and emergency departments. Meta-analysis of the number of consultations (proxy for doctors' workload) with chronically ill patients didn't show any differences between groups (chapter 10).

The effects of skill mix changes on the doctors' workload has rarely been studied in rigourous studies. It is, therefore, too early to draw strong conclusions. Reduction of workload seems, however, to depend on different factors including, the skill mix model applied, changes in doctors' behaviour and practice organization, the target groups, and tasks and responsibilities of nurses. First, although the evidence base is still limited, the findings reported in this thesis suggest that different skill mix models – either substitution or supplementation – will result in different findings. Substitution of tasks from doctors to nurses has the potential to reduce doctors' workload whereas, within the supplementation model, no immediate reduction of doctors' workload is expected. Second, in either case the addition of nurses to primary care teams may not reduce workload unless active steps are taken to ensure doctors discontinue providing the services that have been transferred to nurses.[18] The out-of-office services and nurse triage systems seem promising innovative services with regard to workload reductions.[19,20] Third, according to the literature the extent to which tasks can be delegated from doctors to nurses ranged from 4% to 90%.[13] Timmers et al[21] concluded that workload may only be reduced when nurses are deployed for minor illnesses and cardiovascular diseases, and no such reduction is anticipated when

nurses are deployed for the management of chronic diseases. Nevertheless, Sorgdrager et al (2003)[22] found a reduction in workload when nurses took care of Chronic Obstructive Pulmonary Disease (COPD) and asthma. Son et al (2004)[23] found that doctors' workload was reduced in the case of diabetes patients, while it increased in the case of COPD and asthma patients.

c. Quality of care: equal or better?

Our trial showed that asthma and COPD patients were more likely to be regularly followed-up and reminded of follow-up consultations when nurse practitioners were members of the general practice team (chapter 6). Also, the lung function was more likely to be measured according to guideline recommendations when nurses were involved in respiratory care. Although these aspects of respiratory care improved with the introduction of nurse practitioners in general practices, there still is room for improvement. Both systematic reviews (chapter 9 and 10) showed similar effects of skill mix change. It is concluded that nurses produced as high quality care as general practitioners. This was achieved when nurses worked as doctors' substitute as well as when nurses worked as doctors' supplements. Futhermore, on the basis of our trial, we conclude that nurse practitioners are able to support general practitioners not only when clear protocols are available, but also when no protocols were available and 'on the spot' judgement is required (e.g. patients with dementia or oncology) (chapter 4).

Many publications[e g 13,24-27] support the evidence that appropriately trained nurses can produce as high quality care as primary care doctors. There is some evidence that the quality of care may even improve when nurses are involved in primary care services.

d. Patients' health, preference and satisfaction and determinants

- *Patients' health: gain or loss?*

Within our trial we didn't find improved health (chapter 6), but both systematic reviews (chapter 9 and 10) found that nurses achieved as good health outcomes for patients as doctors, regardless of the target group (i.e. first contact, preventive services or chronic disease managment) or skill mix model (i.e. substitution or supplementation). For the supplementation model we were able to perform different meta-analysis. We saw a significant reduction in the number of deaths (3 studies) when nurses provided preventive services which complemented the usual care services, all three studies dealt with elderly patients. Also, adherence to screening improved, but the difference was not statistically significant. Furthermore, we saw a significant reduction in risk factors related to cardiovascular diseases and significantly improved self-reported health when nurses were

involved in the management of chronic diseases. Semi-quantitative analysis of other patients outcomes also tended to favor nurse involvement. The findings are in line with other research.[e g 13,24-27]

- *Patients' preference and satisfaction: how do patients view skill mix changes?*

The results of our trial showed that patients were generally very satisfied with both general practitioners and nurse practitioners (chapter 7). Patients were significantly more satisfied with the nurse for those aspects of care related to the support for patient and family and time made available to the patient. Both systematic reviews also showed that patients were generally more satisfied with nurse-led care compared to usual care (chapter 9 and 10). The high levels of satisfaction with nurse-led care didn't, however, inevitably meant that patients preferred nurses to doctors.

While satisfaction is often the subject of research, preference has rarely been studied. One of the first studies on nurse practitioners[28] showed that although patients were satisfied with nurse led care, still 70% of patients preferred the general practitioner as first contact. Although more patients in the intervention group preferred the nurse practitioner as an alternative to the family physician, an even higher percentage of patients chose to see a physician employed at the hospital outpatient department, accident and emergency department or second primary care offices. In line with our findings, other studies showed that patients prefer to see a physician for more serious and complex illnesses, and a nurse for routine and minor illnesses.[29]

Within our trial (chapter 7) none of the measured patient, general practitioner/general practice or nurse practitioner related characteristics predicted patients' preference, whereas patients' satisfaction was positively associated with the number of contacts with the nurse. Other studies have found higher levels of satisfaction when the length of consultation is increased.[29-32] Other factors such as style of consulting, questioning skills and emphasis on other aspects of care than prescribing also contributed to higher levels of nurse satisfaction.[32] Familiarity and trust were associated with preference for consulting the physician.[29,30] This might also be the case in our trial as satisfaction with the nurse practitioners increased with having consulted the nurse more often. Initial trust may lead to these higher consultation rates. Finally, continuity of care, being (un)familiar with the professional status of nurses, and nurses' qualifications, accountability and responsibility were other possible determinants explaining levels of satisfaction and preference.[29-32]

e Resource utilization and costs savings or -expansion?

Within our trial we saw an increased number of consultations with the general practice team which were attributable to visits to the nurse practitioner for respiratory care (chapter 6) Both reviews (chapter 9 and 10) found mixed results regarding the effect on volume of resource use Some studies found an increased use of resource, such as longer consultations and increased number of consultations, whereas others didn't found such increase in resource use Different aspects of resource use (e g duration of consultation, number of consultations, prescriptions and tests and investigations, et cetera) were, however, studied in only a few studies, and therefore it is too soon to draw confirm conclusions

The cost-effectiveness of skill mix changes also remains unclear The results of economic trials were mixed, skill mix changes were reported as cost-neutral, cost-saving, and cost-expanding [13] Although people might expect cost-savings when care is delegated to nurses, in our substitution review (chapter 9) only one[33] in five trials showed a cost reduction A recent publication[34] investigating the cost difference of employing either extra salaried general practitioners or nurse practitioners to deal with excess patient demand showed that the costs were equal, regardless of whether only salary and on-costs were included or whether costs of qualifications and training were included We anticipate that clear cost savings with nurse substitution are not established, as the lower salary costs of nurses are offset by the increased use of resources or lower productivity Lower productivity of nurses as compared with doctors may reflect their relative inexperience, and with more experience productivity might increase The analysis of nurse practitioners work (chapter 4) showed that length of consultions decreased whilst nurses became more experienced in their role Nevertheless, other studies[35,36] showed that experienced nurses also were less productive compared to doctors

It is not expected that nurse supplementation lead to (short-term) cost-savings, as nurse supplements provide additional services which complement or extend the usual care services Costs and cost-effectiveness of nurse supplementation is hardly been studied, only 7 out of 32 studies reported economic results (chapter 10) The findings are mixed, in the area of preventive health care services the benefits did not outweigh the costs (n=3), whereas in the area of management of chronic diseases three studies showed a reduction in health care costs, whereas one study found an increase in health care costs Others showed also mixed economic results Although some studies[37,38] reported relativelly low incremental costs (e g £1,236 for secondary prevention clincic for cardiovascular disease[37], $3,331 for a chronic disease management program for hypertension and diabetes[38]) compared to other health interventions, whether or not the extra costs are justified is a matter of judgement for 'payers' such as health care managers and policy makers, how much are they willing to pay per Quality Adjusted Life Year (QALY)?

It is concluded that volume of resource use and cost-effectiveness appeared to be determined by type of nursing role (i.e. substitution or supplementation), target group and responsibilities of the nurses. Substitution has the potential to reduce costs, but whether it does so in practice will depend on local contextual factors. Supplementation may increase costs but has the potential to improve quality. Whether the gains in quality justify the added costs will depend on local contextual factors.

Methodological considerations

A variety of research methods was used to answer the research questions posed in this thesis. In this paragraph several methodological strengths and limitations are discussed.

Cluster randomized controlled trial

A first issue is the relatively low response (67%) of general practitioners to post intervention measures. The drop-out was higher in the intervention group and may reflect the uncertainty at that time about whether or not the deployment of nurse practitioners could be sustained. In June 1999 the Dutch Association of General Practitioners (LHV), Department of Health, Welfare and Sports (VWS) and the National Health Insurance (ZN) signed an agreement regarding the broad implementation of nurse practitioners in Dutch general practices.[39] With the signing of this agreement the employement of nurse practitioners in general practice was financially supported by health insurance companies under the condition that general practices met some criteria. In the first years there was, however, a lot of debate about the exact amount of financial support and also about what criteria needed to be fullfilled.[40] Another explanation may be that, at post intervention measurement, general practitioners didn't want to invest time in the evaluation since the agreement made it possible to implement nurse practitioners even without scientific evidence of the effectiveness and efficiency. During the trial the control group didn't employ nurse practitioners, so we were still able to establish the effectiveness of nurse practitioners. Comparison of pre-measurement data didn't reveal differences between respondents and non-respondent, so despite the relatively low response we have convidence that our findings reflect the effect on general practitioners' workload.

An explanation of the relatively small effects may be the fact that the trial was set up as practice-based effectiveness study meaning that the interference with normal care delivery was minimized to the addition of nurse practitioners. Therefore, this trial reflects the effects of adding nurse practitioners to the general practice compared with not adding such nurses under normal practice conditions. Stronger effects may, however, have been found if some preconditions had been met. We didn't dictate whether or not practice assistants/practice nurses should have to work for the nurse practitioner in handling patient

calls or carrying out administrative tasks; and although the availability of a treatment room in each practice was recommended, we didn't interfere with the organization of this. In some cases restrictions on treatment room availability led to a higher number of house visits by the nurse practitioners, which is inefficient as fewer patients can be seen in comparison with consultations at the surgergy. It is likely that nurse practitioners would have been more efficient had they been supported by practice assistants in administrative tasks and handling of patient calls, et cetera.

Another explanation of the relatively small effects may be the number of hours spent by the nurse practitioner per individual general practitioner. The number of hours was related to the number of referrals which varied greatly between general practitioners (range 11 to 157). As all general practitioners were included (intention-to-treat-analysis) this may have led to underestimation of effects. Furthermore, as the analysis of the nurse practitioners' work showed, part of their work appeared to be outside the scope of our measurements, which may have led to underestimation of effects.

A final methodological consideration is that the trial had a relatively short intervention period (18 months) in which professionals both within the general practices and in other settings (e.g. hospital, district nursing services) had to get accustomed to the nurse practitioners. It is likely that larger effects would have been detected had a longer intervention and follow-up period been used. Due to financial restrictions this was impossible.

The effects found in our trial were relatively small, but nevertheless the findings are relevant as they suggest that the quality of care can be improved by the employment of nurse practitioners working as doctors' supplements. Furthermore, they are consistent with other research.

Systematic reviews

Two systematic reviews were conducted to study the effects of substitution and supplementation, respectivley. We systematically appraised and synthesized research evidence from original studies using an *a priori* established protocol, and thus minimized the risk of bias, including as much of the relevant research as possible and being transparent, thus enabling replication.[41,42] A highly sensitive literature search was used to maximize the detection of relevant studies. Even so, publication bias can't be ruled out completely as the included papers were restricted to English and Dutch publications, and 'grey' literature wasn't taken into account. However, we did screen the English abstracts of papers published in other languages and found none that appeared relevant. Furthermore, meta-analysis could only be applied to a limited number of outcomes and studies. Due to heterogeneity between studies meta-analysis was restricted to Fixed Effects models. This

approach provides reliable estimates of the average effect and confidence intervals across included studies, but findings cannot be generalized beyond these studies to the wider population of practitioners and practices.[43] A qualitative judgement based on assessment of all the available evidence showed the same direction of results, giving confidence in the positive effects of skill mix changes on patients' health, satisfaction and quality of care.

Implication for further research

One of the drivers for skill mix change is the increased workload of general practitioners and increased demand for care. The effect of skill mix changes on the workload has, however, rarely been taken into account in research. Observational studies[c g 44-46] and anecdotes showed reduction of doctors' workload, but there is no good research evidence to underpin this point. The findings from (randomized) controlled trials are conflicting and therefore not conclusive. We share the views that in a properly managed general practice, the doctor's workload could be reduced through the addition of nurse practitioners to the team. But only when nurse practitioners provide the same services as general practitioners, not when they are deployed as doctors' supplements. Future research into teamworking between doctors and nurses should focus on the factors which facilitate delegation of tasks from doctors to nurses and how doctors invest their time and, if shown, their time savings.[47]

Another objective of skill mix change is cost containment. Looking at salary costs nurses are generally cheaper than doctors and therefore it is expected that shifting work from doctors to nurses will be cost-effective. Although this is a valid assumption, the evidence on this point is not clear. Some studies found cost savings, but others haven't.[13] The amount of cost savings, but even more importantly the cost-effectiveness, is likely to be dependent on the applied skill mix model. The current research showed no cost savings when nurse practitioners worked as doctors' substitutes. The lower salary costs of nurses were offset by their increased use of resources and lower productivity. How these two aspects relate to quality of care management is unclear. Perhaps increased use of services, prescriptions, and test and investigations positively affected patients' health resulting in costs savings in other settings such as a reduction in emergency calls, hospital admissions, and work-loss days.

It is also unclear whether or not supplementation will lead to cost savings or is cost-effective. We couldn't draw a confirm conclusion; only 7 out of 32 studies reported costs and cost-effectiveness. The results were mixed. By virtue of the intervention, costs will increase as nurse practitioners offer additional services to the practice population. Despite health care cost may rise, the addition of nurses to primary care teams is welcome if it

improves quality of care by dealing with unrecognized problems/pre-existing problems and improving management of patients with chronic diseases or the elderly.

Future research should give more attention to implementation costs (including educational training, extra staff meetings, adjustments to medical records, et cetera) and to financial aspects of (non-) health care in the short and long term related to the intervention (including costs for prescribing, hospital stay, length of consultations, but also travel time, time of work due to follow-up exams, labour participation, et cetera). This and other information is needed to eventually establish the costs-effectiveness of the intervention, for example, in terms of cost per life year saved or quality adjusted life years.

Future research should also be focussed at the most effective mix of staff achievable within available resources.[48] How are patients best served? Who should provide the necessary services? How should this be arranged, how does this influence the continuity of care? Nurses in many countries provide a wide range of services; only a small part of these services is present in the current research literature. Levels of training, responsibilities, qualifications and experience also differ between and even within countries, and this has received inadequate attention in current research. It is recommended that the characteristics of the team (both doctors, nurses and other staff members) are reported more often, more consistently and related to the (cost-) effectiveness. Insight into the 'black box' will help policy makers, health care organizations and professionals to weigh the benefits and disadvantages in deciding the effective mix of staff.

Finally, the methodological quality of studies should be given attention. Although cluster randomized controlled trials are preferred, it would be difficult to conduct this type of study as the majority of general practices already deploy nurse practitioners. Yet within a practice patients could be randomized to nurse or physician. In that case researchers have the responsibility to take measures to avoid contamination between groups. Alternative designs, such as longitudinal studies, interrupted time series, practice-based effectiveness studies, controlled block designs (i.e. nurses proving COPD care versus nurses providing diabetes care; or nurse practitioners versus other non physician staff) and also qualitative research designs should be considered. To reduce the effect of any individual practitioners on outcomes, future studies should also seek to maximize the number of practitioners, rather than increasing the numbers of patients, and/or adjust for cluster effects by practitioner.

The research questions for further research are summarized in box 1.

Box 1. Summary implications further research

Topic	*Research questions*
General practitioners workload	The effect of different skill mix models on general practitioners' workload, both objective workload and subjective workload?
Prescription	The effects of independent prescribing by nurses on patients' health, quality of care and service use? Are nurses able to prescribe drugs safely?
Cost-effectiveness	The cost-effectiveness of different skill mix models (including intervention costs, non-health care and health care costs, and long term health gains if any)?
Mix of staff	What is the optimum mix of staff?: - Which practitioner are both available and have the necessary skills and competencies to deliver the required services? - What minimal qualifications/training should these professionals have? - How should this mix of staff be arranged and regulated? - How can continuity of care be served? - Which mix of staff results in the best patient outcomes?

Implications for health policy

In this paragraph two health policy issues will be highlighted: the introduction of new non-medical professionals in general practice and independent prescribing by nurses.

The introduction of new non-medical professionals in general practice

Skill mix change is a dynamic process. Skill mix change is often preceded by a period in which tasks from one type of professional are informally performed by another type of professional. After a period of time these skill mix changes may become formalized and codified in law.[27] This has occurred in the Netherlands as the roles of practice assistants have been professionalized and new non-medical professionals have been introduced since the mid 1990s. Practice assistants have been shown to perform significantly more medical-technical tasks and more patient information tasks in 2002 compared to 1997-99 and to 1994.[49,50] Their role is comparable to the practice nurse in the UK.[51] This extension of roles is, in spite of advice from the Council for Public Health and Health Care (RVZ), not regulated by law. In addition to practice assistants, some pilot projects started in the early 1990s in which nurses ("praktijkondersteuners"; primary care nurses[a]) were deployed, particularly to manage patients with chronic diseases such as diabetes, asthma, COPD, and to care for the elderly ('friendly visits').[4,52] At that time there was no clear definition of nurses' function and responsibilities, postgraduate training was lacking, and employers varied (for example district nursing services, general practice).[52,53] The role of these nurses

[a] To avoid confusion with the latter implemented 'nurse practitioners' we here use the term primary care nurse referring to the Dutch "praktijkondersteuner/-verpleegkundige". The nurses in our trial were one of the first primary care nurses, but at that time we used the term nurse practitioner as this is a more customary term.

has since been developed; their competences and responsiblities are now documented[54] and their education has been formalized. Nevertheless the function and title is not yet regulated by law, which may hinder further development such as independent prescriping. The larger part of their work consists of taking care of patients with diabetes, asthma or COPD and heart failure.[54,55] Nowadays, about 70% of general practices employ primary care nurses.[55] Forty-six percent of general practices report that primary care nurses support them in the management of patients with multiple chronic diseases, and about 19% report that they are occasionally supported in the management of chronic diseases. Furthermore one third of general practices are supported by nurses in their general practice care for minor illnesses. A majority would support expanding of role of these primary care nurses.[56]

Early in 2000, two other new non-medical professionals were introduced: nurse practitioners (not to be confused with primary care nurses/"praktijkondersteuner"[a]) and physician assistants. Although these professionals were first introduced and trained in hospital settings,[57] a minority switched to primary care settings. In spring 2007, approximately 48 nurse practitioners and 15 physician assistants were employed at primary care practices.[58-60] The nurse practitioners focus on common complaints in general practice (i.e. minor ailments), whereas the physician assistants work is wider in scope, covering all types of complaints and patient groups.[61-64] In daily practice there is certainly overlap between the tasks actually performed by the different non-medical professionals.[55,65-67] In 2008 another new non-medical professional will be introduced in the general practice. This professional will support the general practitioner in the care for patients with mental health problems or symptoms. There is, however, uncertainty about the tasks and responsibilities and also about educational training.[68]

The introduction of these non-medical professionals in the Netherlands is comparable with developments in the USA, UK, Australia and other Western countries.[69-71] but is following a much more rapid tempo. Professionals have hardly had the chance to prove themselves and realize the full potential of their roles at the risk they become competitors.[72] When the introduction of new professional roles takes place too quickly this may lead to confusion and impede implementation. In the Netherlands, general practitioners in particular seem uncomfortable with nurse practitioners and physician assistants, although there are exceptions.[65,73-75] Fragmentation of primary care across several health care professionals creates a risk of a lack of coordination and continutiy in primary care provision.[76] Future health policy should avoid further proliferation of the non-medical professionals; it is recommended that the pace of changes are moderated to allow existing staff and patients become accustomed with these non-medical professionals. Furthermore, (future) health policy should aim to provide clear job descriptions for these new professionals, in which tasks, responsibilities and qualifications are clear and

distinguishable from those of physicians and other professionals. Both the effectiveness of nurse practitioners and physician assistants employed in Dutch general practice are currently being evaluated.[77,78] It is recommended that also the cost-effectiveness of "mental health primary care provider" is evaluated. If evidence shows that these professionals contribute to improved quality of care and cost-effectiveness they should be encouraged to expand in numbers. The non-medical professionals will particularly benefit by having a clear description of their competencies and responsibilities.

Our research has not focused on specialist nurses, such as diabetes,[7] respiratory,[79] and geriatric nurses[80] who are often employed at the hospital but also contribute to general practice care ("mediated care"). They too should be taken into account when seeking to optimize mix of health care professionals. Ideally, future health policy should look to optimize the mix of non-medical and medical professionals based on evidence from research.

Independent prescribing by nurses

In recent years, all over the world, there has been a debate about whether or not advanced nurses should have the legal authority to independently prescribe all kind of drugs.[81-84] Many doctors, nurses and patients welcome laws which permit nurses to become independent prescibers, whilst others such as doctor organizations and also doctors, nurses and patients have expressed concern.[81-90] In the Netherlands, the Dutch House of Representatives passed a new drugs law which enables nurse specialists to independently prescribe drugs.[91] In February 2007 the Senate approved this law ("Geneesmiddelenwet"). The law states that the prescription of drugs is a reserved procedure. Before nurse specialists actually are permitted to independently prescribe drugs, the Individual Health Care Professionals Act ("Wet BIG") needs to be adjusted as nurse specialists are not yet defined.[92] What are the consequences of this new law? Latter et al (2005)[93] found that nurses generally prescribed appropriately. The fact that the majority of advanced nurses, such as nurse specialists, were not allowed to independently prescribe drugs was seen as a barrier by both doctors[94] and patients[29] as it interrupted service delivery due to the fact that physicians had to sign prescriptions. In daily practice, nurses sought to avoid this limitation by, among other things, using presigned prescription pads, prescribing other drugs which they were allowed to (e.g. medication V; in USA), and referring the patient to a doctor for assessment and management.[95,96] So, daily practice would certainly benefit by legislation permitting nurses to prescribe independently. Future research should be aimed at elucidating the safety and effectiveness of independent nurse prescribers.

Final conclusion

It is concluded that the addition of nurses to primary care teams - both substitution and supplementation - is an effective strategy in improving the quality of primary care services. Nurses are effective in the delivery of a wide range of services, such as first contact for patients wanting urgent attention, preventive health care, and chronic disease management. Patients are positive about the services provided by nurses. Nurses can achieve as good health outcomes, and in some respects moderately improved health outcomes, compared to general practitioners. The effect on doctors' workload and cost-effectiveness is unclear and requires further investigations. Finally, policy should seek to optimize the mix of health care professionals within the available resources.

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Summary

The focus of the thesis has been on the *revision of professional roles* in primary care, in particular the shift of specific aspects of primary care to nurses. Skill mix changes have been widely implemented, although these have not been adequately studied. The evidence base for skill mix changes is generally not robust and has lagged behind service developments. Chapter 1 describes the objective and research questions of the present thesis. The purpose was to gain insight into:

- factors governing skill mix changes, mechanisms of change and the impact of skill mix changes on care provision, professionals and patients (Chapter 2);
- characteristics of four different types of nurses who supported the Dutch primary care doctor in patient health care (Chapter 3);
- tasks, responsibilities and developments in nurse practitioners' role (Chapter 4);
- the effects of skill mix changes, in particular the shift of specific aspects of primary health care to nurses, on doctors' workload, quality of care, patients' health, preference and satisfaction, and resource utilization and costs (Chapter 5 to 10); and
- factors that impede or facilitate succesfull implementation of nurse practitioners in primary care (Chapter 8).

In three sections the different chapters of this thesis will be summarized; each paragraph starts with the research question(s).

Part I Exploration of the concept of skill mix changes

Factors governing skill mix changes (Chapter 2)

"What is known about factors governing change, mechanisms of change and the impact of skill mix changes on care provision, professionals and patients?"

A narrative review of the literature showed that the factors motivating skill mix changes are many and complex. The factors governing change are interdependent. The expansion of advanced nursing roles is driven by, amongst other issues, rising costs of health care provision, demand for increased and improved services access, health workforce shortages, pressures to fulfill contractual commitments, and the skills and expertise of nurses. The overall aim of skill mix change is to improve health care effectiveness and efficiency. There is some evidence that skill mix change has a positive impact on patient satisfaction, quality of care and resource utilization. However, evidence is lacking on the effects on health care costs, doctors' workload and the best mix of tasks and skills that different primary care professionals should undertake. The impact of skill mix changes is most likely also dependent on the health care system as a whole, actual changes in task profiles and primary care management. Skill mix change in one part of the health care system may impact on other parts with unforseeen consequences.

Characteristics of different types of nurses supporting the Dutch general practitioner in patient care (Chapter 3)

"Which skill mix models do exist in primary care and how are these models deployed?"

An observational study, using postal questionnaires and semi-structured telephone interviews, was conducted to explore how often each of four types of nurses (advanced practice nurse; district nurse; nurse practitioner and nurse specialist) were supporting the Dutch general practitioner, and what type of roles the nurses fulfilled. Advanced practice nurses often had a small range of tasks, and were predominantly involved in preventive care. About 40% provided care to more than two patient groups, most often to patients with diabets and hypertension. They only worked in the doctors' office. District nurses had a broad range of work: from taking patients' histories and making inventories of problems to coordination of care and liaison activities. Patients were seen in the doctor's office or at home. The majority of patients had diabetes, asthma, Chronic Obstructive Pulmonary Disease (COPD) or oncological diseases. The majority of the nurses was responsible for the care of more than two patient groups. Nurse practitioners also fulfilled a broad range of work. They often saw the patients at home as well as at the surgery. They had frequent telephone contact with the patients. They were deployed for various target groups, and the vast majority saw patients with diabetes, asthma and COPD. Finally, the nurse specialists were predominantly responsible for only one specific patient group. Half of the nurses were involved in diabetic care. Most patients were visited at their homes. Only a minority was seen in the doctors' office or contacted by phone.

It was concluded that each type of nurse had its own specific characteristics, but differences were seen in tasks and target groups among nurses of the same type. Additionally, there was an overlap between different types of nurses regarding their tasks and target groups.

Part II Impact of skill mix changes in the Netherlands

In order to find out whether or not the introduction of nurse practitioners would decrease doctors' workload and maintain quality of care, a cluster randomized controlled trial (n=34 general practices) was conducted. After a short training course, experienced community nurses started to work as nurse practitioners within 20 general practices. The remaining practices (n=14) formed the control group and received no extra support in patient care. The tasks and responsibilities of the nurses in relation to the other team members (i.e. general practitioner and practice nurses/assistants) were described in agreed guidelines and concerned the care for patients with asthma, COPD, dementia, and cancer and for the elderly waiting to be admitted to a nursing home.

Tasks, responsibilities and developments in nurse practitioners' role (Chapter 4)

"Which forms of care are delegated to and provided by nurse practioners in general practice?"

During the 18-month study period general practitioners referred 1793 patients and the nurse practitioners contacted those patients 9942 times. The majority of the contacts consisted of house calls, and the majority of the patients seen had asthma or COPD. The number of referrals and consultations increased over the course of the project, while the time spent per consultation decreased over time, which indicates that there is a habituation period for both the general practitioner and the nurse practioner. The findings also suggest that nurse practitioners can support general practitioners, not only in the management of chronically ill patients but also in the care of patients with complex needs.

Impact on general practitioners' workload (Chapter 5)

"What is the impact on general practitioners' workload of adding nurse practitioners to the general practice team?"

The doctors' objective workload did not decrease. Measures of objective workload, expressed as the number of consultations during surgery hours and out of hours, increased in the short term. In particular the number of contacts with asthma and COPD patients increased during surgery hours. This increase might be explained by the fact that nurse practitioners discovered unrecognized problems that demanded doctors' attention. The number of contacts out of hours decreased slightly, which might indicate an improved quality of care during surgery hours by the nurse practitioner thus preventing calls out of hours. Although we expected that nursing support would have reduced the stress of a demanding job, we did not find a difference in subjective workload measures.

Impact on quality of respiratory care, service use and patients' health (Chapter 6)

"What is the effect of adding nurse practitioners to the general practice team on respiratory care?"

"What role does the nurse practitioner perform: substitute or supplement?"

The general practice team was more involved in respiratory care when the nurse practitioner was a member of the general practice team. Although there were still deficiencies (deviations from guidelines) in the respiratory care provided by the general practice team, the regular monitoring of patients with asthma and COPD improved. Also the lung function of newly diagnosed patients as well as COPD patients was more in line with the guidelines. Patients had considerably more consultations with the general practice team when a nurse practitioner was a member of that team. In contrast to the findings on

doctors' workload, the number of consultations with the general practitioners was comparable in the intervention and control group.

The findings showed that nurse practitioners worked predominantly as supplements, not as substitutes. The general practitioners still had an important role in patient education and advice, but the nurse practitioners had an leading role in the (regular) measurement of lung function and follow-up of the patients.

Impact on patients' preference and satisfaction and determinants (Chapter 7)

"Are patients equally satisfied with nurse-led care compared to doctor-led care?"

"Which factors determine patients'preference and satisfaction with nurse practitioners and with general practitioners?"

Patients were generally very satisfied with the care provided by both nurse practitioners and general practitioners. The patients tended to be slightly more satisfied with the nurse practitioners, in particular with aspects related to relationships and communication, and support. This did not, however, mean that patients inevitably prefered nurses to doctors. Our findings suggest that patients' preference varied with the type of care required. General practitioners were evidently prefered for medical problems, whereas for routine care, educational interventions and support of patients and their family, patients had no preference, or prefered the nurse practitioner. Variations in preference and satisfaction were most strongly associated with variations in individual patient characteristics.

Factors related to successful introduction of nurse practitioners in general practice (Chapter 8)

"Which factors are related to the successful introduction of nurse practitioners in general practice?"

Successful implementation of the nurse practitioner role in general practice, at least in the Netherlands, seems to depend on a number of factors. Amongst others, these factors include: clear and unambiguous agreements on tasks, responsibilities and patient groups; continued education, training, and supervision of the nurses; and the provision of a nurse treatment room in the surgery. In addition, when implementing nurse practitioner roles, one should keep in mind that the members of the general practice team may require considerable time to develop the mutual understanding and trust needed for optimal performance.

Part III Impact of two skill mix change models

Skill mix is chiefly based on changes in the wider environment, policy, payment systems, professional regulation, training and attitudes, and not necessarily on scientific evidence. Primary care nurses may fullfill different roles; they may work either as doctor substitutes or as doctor supplements. The international literature was reviewed to determine the current state of scientific knowledge concerning these two different types of skill mix models. Nurses working as *substitutes* provide the *same services* as doctors, whereas nurses working as *supplements* provide *additional services* which complement or extend those provided by doctors.

Substitution: nurses provide same care as primary care doctors (Chapter 9)

"What is known about the effects of substitution of primary care on health outcomes, process of care measurements, resource utilization and costs?"

Sixteen trials on substitution were included; 13 randomized controlled trials and three controlled before-after trials. Studies were divided in three categories: first contact and ongoing care for all presenting patients (n=4); first contact for patients wanting urgent attention (n=5); and routine management of patients with chronic conditions (n=4). Six studies were conducted in the UK, six in the USA, and four in Canada. With the exception of one study (18 months follow-up), all studies had a relatively short follow-up period (1 year or less).

Meta-analyses was possible only for a minority of studies and outcome measures, all related to routine management of chronic diseases. Meta-analyses showed that patients' satisfaction was higher with nurse-led care as compared with doctor-led care; nurses were more likely than doctors to recall a patient; but there was no difference between nurses and doctors with regard to volume of prescribing and referral rates to other health services (such as hospitals). Semi-quantitative analysis of the findings related to first contact and ongoing care or urgent care showed the same tendency. Only one of five studies measuring costs demonstrated clear cost savings with nurse-led services. It is unknown if substitution decreases doctors' workload. It was concluded that appropriately trained nurses can produce as high quality care as primary care doctors and achieve as good health outcomes. While doctor-nurse substiution has the potential to reduce doctors' workload and direct healthcare costs, achieving such reductions depends on the particular context and changes the organization of care.

Supplementation nurses provide additional care which extend usual care provided by general practitioners (Chapter 10)

"What is known about the effects of suplementation of primary care on health outcomes, process of care measurements, and resource utilization?"

Thirty-two trials on supplementation were included, 25 randomized controlled trials and seven controlled before-after trials Studies were divided in two categories nurses providing preventive health services (n=15) and nurses managing chronic diseases (n=17) Studies represented an international experience, including data from six countries, although about half were conducted in the UK The majority of the studies had a relatively short follow-up period (1 year or less) The methodological quality of studies was mixed

Meta-analyses was possible only for a minority of studies and outcome measures All outcomes were subjected to semi-quantitative analysis The findings suggest that for both preventive health services and management of chronic diseases the addition of nurses to the primary care team resulted in improved patient outcomes and quality of care

Preventive health services the evidence was strongest in suggesting that nurse supplementation improved the detection and recording of risk factors The benefits in terms of improved health outcomes for patients were less marked, with the exception of studies in elderly patients where mortality was significantly reduced Patient compliance with interventions to reduce risk was not significantly improved by nurse supplementation Resource use appeared higher, although in many instances this was the intended outcome of nurse interventions designed to promote the uptake of specialist services Three studies reported economic results In one study, initial costs decreased, but three months follow-up showed a slight increase Two studies concluded that the short term benefits to patients of cardiovascular risk screening by nurses did not outweigh the costs

Chronic disease management nurse supplementation was associated with improved management, leading to improved risk factor control and self-reported health, and higher patient satisfaction in a wide range of clinical conditions This should in turn lead to slower disease progression and reduced mortality, although there is insufficient evidence to demonstrate whether these gains are achieved in practice There is a paucity of information regarding resource utilization and cost-effectiveness Patient consultation rates and prescription rates do not appear to be increased by nurse supplementation Additional costs of employing a nurse were considered in four studies, three studies showed a reduction in costs, whereas one showed increased costs More research is therefore needed to determine the added cost for each quality-adjusted life year gained through nurse supplementation Whether the gains in quality justify the added costs will depend on local contextual factors

General discussion

The main findings of this thesis are summarized and discussed in chapter 11. This thesis contribute to the body of knowledge on the shift of primary care, or aspects of primary care, from doctors to nurses. It showed that nurses play an important role in primary care services. It is concluded that the addition of nurses to primary care teams - both substitution and supplementation - is an effective strategy in improving the quality of primary care services. Patients are positive about the services provided by nurses. Nurses can achieve as good health outcomes, and in some respects moderately improved health outcomes, compared to doctors. Nurses are effective in the delivery of a wide range of services, such as first contact for patients wanting urgent attention, preventive health care, and chronic disease management. More research is, however, needed into the effects on doctors' workload, the optimum mix of health professionals, and the cost-effectiveness of these changes in staffing.

Samenvatting

Dit proefschrift beschrijft de taakherschikking in de eerstelijnsgezondheidszorg, in het bijzonder de inzet van praktijkondersteuners (c.q. praktijkverpleegkundigen) in de huisartsenpraktijk. Taakherschikking betekent het verschuiven van taken tussen verschillende beroepsbeoefenaren. Wereldwijd zien we dat verpleegkundigen taken van huisartsen overnemen, maar de effecten van het inzetten van deze verpleegkundigen zijn nog onvoldoende bestudeerd. Het wetenschappelijke bewijs voor taakherschikking loopt daarmee achter op deze veranderingen in de gezondheidszorg. Hoofdstuk 1 geeft een algemene inleiding op het onderwerp en beschrijft de doelen en de onderzoeksvragen van dit proefschrift. Deze betreffen:

- een exploratie van factoren die leiden tot taakherschikking en de invloed van taakherschikking op de zorg (hoofdstuk 2)
- inzicht krijgen in de kenmerken van vier verschillende modellen voor praktijkondersteuning in de Nederlandse huisartsenpraktijk (hoofdstuk 3)
- inzicht krijgen in de taken, de verantwoordelijkheden en de ontwikkelingen in de functie van de praktijkondersteuner (hoofdstuk 4)
- het meten van het effect van de inzet van praktijkondersteuners op de werkdruk van huisartsen, de kwaliteit van de zorg, de gezondheid van de patiënt, de voorkeur en de tevredenheid van de patiënt met de zorg, de zorgconsumptie, de kosten en de kosteneffectiviteit (hoofdstuk 5 t/m 10); en
- het achterhalen van factoren die succesvolle implementatie van praktijkondersteuners in de huisartsenpraktijk bevorderen dan wel belemmeren (hoofdstuk 8).

Deel I Exploratie van het concept taakherschikking

Factoren die leiden tot taakherschikking en de invloed van taakherschikking op de zorg (hoofdstuk 2)

Een (niet systematische) literatuurstudie laat zien dat taakherschikking door veel verschillenden factoren wordt gestimuleerd. Deze factoren zijn niet uniek, maar grijpen op elkaar in en versterken elkaar. De volgende factoren dragen bij aan taakherschikking:

- voortdurend stijgende kosten van de gezondheidszorg;
- een toenemende zorgvraag en vraag naar verbeterde bereikbaarheid van de zorg;
- schaarste aan (huis)artsen;
- de ervaren druk van (huis)artsen om aan contractuele verplichtingen te voldoen; en
- de toegenomen vaardigheden en expertise van andere zorgverleners, zoals verpleegkundigen.

Taakherschikking heeft tot doel het verbeteren van de effectiviteit en de doelmatigheid van gezondheidszorg. Er zijn aanwijzingen dat taakherschikking leidt tot hogere patiënt-

tevredenheid, verbetering van de kwaliteit van de zorg en efficiënter gebruik van middelen. Echter, het is onbekend of taakherschikking leidt tot kostenreductie in de zorg en of de werkdruk van (huis)artsen wordt verminderd. Ook is onbekend wat de optimale mix van taken, vaardigheden en competenties van de verschillende zorgverleners zou moeten zijn. Het effect van taakherschikking lijkt afhankelijk van het zorgsysteem en de feitelijke veranderingen in functies en in het praktijkmanagement. Het herverdelen van taken tussen verschillende zorgverleners in één deel van het zorgsysteem is zeer waarschijnlijk van invloed op andere delen van het zorgsysteem en leidt mogelijk tot onvoorziene neveneffecten.

Kenmerken van vier verschillende modellen voor praktijkondersteuning in de Nederlandse huisartsenpraktijk (hoofdstuk 3)

Met een observationele studie is nagegaan hoe vaak de Nederlandse huisartsen in de patiëntenzorg worden ondersteund door:

a) praktijkassistenten plus (c.q. bijgeschoolde praktijkassistenten);
b) gespecialiseerde wijkverpleegkundigen;
c) praktijkondersteuners (c.q. praktijkverpleegkundigen); en
d) (transmuraal) gespecialiseerd verpleegkundigen,

en wat de kenmerken van deze vier modellen voor praktijkondersteuning zijn. Hiervoor is landelijk een schriftelijke vragenlijst uitgezet onder District Huisartsen Verenigingen, Transmuraal Diagnostische Centra, gezondheidscentra en thuiszorginstelling; vervolgens is bij een steekproef van respondenten (i.e. projectleiders) een semi-gestructureerd telefonisch interview afgenomen.

Uit de vragenlijst bleek dat 85% van de respondenten betrokken was bij één of meer projecten waarbij de huisartsen een beroep konden doen op één of meer modellen voor praktijkondersteuning. In de meeste projecten betrof dit de inzet van gespecialiseerde wijkverpleegkundigen.

In het interview werden de kenmerken van de verschillende modellen voor praktijkondersteuning in kaart gebracht. De praktijkassistenten plus boden de huisartsen ondersteuning bij de preventieve zorg, onder meer het geven van voorlichting, advisering en het uitvoeren van routine controles. Het takenpakket was relatief beperkt. Veelal verleenden de praktijkassistenten zorg aan meer dan twee patiëntgroepen, zoals patiënten met diabetes mellitus (suikerziekte) en hypertensie (hoge bloeddruk). De patiënten werden alleen in de huisartsenpraktijk gezien. De gespecialiseerde wijkverpleegkundigen hadden een brede taakinvulling: van anamnese/inventarisatie van problemen tot coördinatie/liaison taken. De zorg werd zowel in de huisartsenpraktijk (spreekuur) als bij de patiënt thuis geboden. De meerderheid van de patiënten leed aan diabetes mellitus, astma, Chronic

Obstructive Pulmonary Disease (COPD) of kanker. De meeste wijkverpleegkundigen ondersteunden de huisarts in de zorg voor meer dan twee patiëntgroepen. De praktijkondersteuners hadden ook een breed takenpakket en net als de gespecialiseerde wijkverpleegkundigen werden de patiënten zowel in de huisartsenpraktijk als thuis gezien. De praktijkondersteuners werden voor verschillende patiëntgroepen ingezet. Zij ondersteunden de huisartsen voornamelijk in de zorg voor patiënten met diabetes mellitus, astma en COPD. Tot slot, de gespecialiseerde (transmuraal) verpleegkundigen uit het ziekenhuis werden vaak voor slechts één patiëntgroep ingezet. De helft van deze verpleegkundigen ondersteunde de huisarts in de zorg voor patiënten met diabetes. De patiënten werden vaak thuis bezocht en slechts zelden werd de zorg in de huisartsenpraktijk aangeboden.

Concluderend kan gezegd worden dat er relatief veel projecten werden uitgevoerd waarbij huisartsen een beroep konden doen op één of meer van eerdergenoemde zorgverleners. De verschillende ondersteuningsmodellen hadden ieder specifieke kenmerken, maar er bestond ook variatie in taken en patiëntgroepen binnen hetzelfde model. Verder bestond er overlap in taken en patiëntgroepen tussen de verschillende ondersteuningsmodellen.

Deel II Het effect van de inzet van praktijkondersteuners in Nederland

Om de effecten van de inzet van praktijkondersteuners op de werkdruk van huisartsen en op de kwaliteit van zorg te kunnen vaststellen, is een cluster-gerandomiseerde studie uitgevoerd in 34 Nederlandse huisartsenpraktijken. Na een korte training startten vijf ervaren wijkverpleegkundigen als praktijkondersteuners in 20 huisartsenpraktijken. De overige 14 huisartsenpraktijken vormden de controle praktijken; zij ontvingen geen extra ondersteuning in de patiëntenzorg. De taken en de verantwoordelijkheden van de praktijkondersteuners in relatie tot de taken en de verantwoordelijkheden van de overige praktijkmedewerkers (de huisartsen en de praktijkassistenten) waren in een takenpakket beschreven en omvatte de zorg voor patiënten met astma, COPD, dementie en kanker en ouderen die op een wachtlijst stonden voor opname in een verpleeghuis.

Taken, verantwoordelijkheden en ontwikkelingen in de functie van de praktijkondersteuners (hoofdstuk 4)

Uit de cluster-gerandomiseerde studie bleek dat in de studieperiode (18 maanden) de huisartsen in het totaal 1793 patiënten hadden verwezen. De praktijkondersteuners hadden in het totaal 9942 contacten met deze patiënten. De meerderheid van de contacten bestond uit een huisbezoek en de meeste patiënten hadden astma of COPD. Het aantal verwijzingen en het aantal contacten nam toe naarmate de praktijkondersteuner langer in de

huisartsenpraktijk werkzaam was. Tegelijkertijd zagen we een afname in de gemiddelde tijd per contact naarmate de praktijkondersteuner langer in de huisartsenpraktijk werkzaam was. Dit duidt op een gewenningsperiode c.q. leerperiode voor zowel de huisarts als de praktijkondersteuner. Dit onderzoek toonde aan dat praktijkondersteuners het handelen van huisartsen kunnen ondersteunen, niet alleen bij patiënten met een chronische aandoening, maar ook bij patiënten die meer complexe zorg nodig hebben.

Effect van de inzet van praktijkondersteuners op de werkdruk van huisartsen (hoofdstuk 5)
Uit de cluster-gerandomiseerde studie bleek ook dat de inzet van praktijkondersteuners niet resulteerde in een vermindering van de objectieve werkdruk van huisartsen. Hierbij werd de objectieve werkdruk uitgedrukt in het aantal patiëntcontacten tijdens en buiten kantooruren. Na 18 maanden was een toename in de objectieve werkdruk zichtbaar; het aantal contacten met astma en COPD patiënten tijdens kantooruren nam toe. Deze toename kan mogelijk verklaard worden doordat praktijkondersteuners bij deze groep patiënten niet eerder gesignaleerde problemen ontdekten die de aandacht van huisartsen behoefden. Het aantal contacten buiten kantooruren nam enigszins af. Dit duidt mogelijk op een verbetering van de kwaliteit van de zorg waarmee voorkomen werd dat patiënten buiten kantooruren een beroep op de huisartsen doen. Hoewel we verwacht hadden dat de praktijkondersteuning tot een vermindering van subjectieve werkdruk (i.e. stress) zou leiden, konden we dit niet aantonen. We vonden geen verschil tussen interventiegroep en controlegroep ten aanzien van subjectieve werkdruk.

Effect van de inzet van praktijkondersteuners op de kwaliteit van zorg voor patiënten met longaandoeningen, het zorggebruik en de gezondheid (hoofdstuk 6)
De cluster-gerandomiseerde studie laat zien dat huisartsenpraktijken die door een praktijkondersteuner werden ondersteund (interventiegroep) vaker betrokken waren bij, of verantwoordelijk waren voor de zorg voor patiënten met longaandoeningen, dan de huisartsenpraktijken uit de controlegroep. Hoewel ook na 18 maanden in interventiepraktijken de zorg voor deze groep patiënten niet optimaal was (ten opzichte van aanbevelingen in de NHG-standaarden) was er een duidelijke verbetering in de monitoring van deze patiënten zichtbaar. Ook werd er vaker een longfunctiemeting uitgevoerd conform de aanbevelingen in de NHG-standaarden. Patiënten in de interventiegroep hadden echter ook beduidend meer contacten. In tegenstelling tot de bevindingen over werkdruk, was er geen verschil in het aantal contacten met de huisartsen in de interventiegroep en in de controlegroep. Het verschil in het aantal contacten werd dus veroorzaakt door de zorg die de praktijkondersteuners aan patiënten boden.

De bevindingen laten zien dat de praktijkondersteuners voornamelijk extra taken of taken die waren blijven liggen uitvoerden (supplementatie) en feitelijk niet de taken van de huisartsen overnamen (substitutie). Huisartsen hadden nog steeds een belangrijke rol in het geven van voorlichting en adviezen, maar de praktijkondersteuners hadden een leidende rol in het routinematig meten van de longfunctie en in de monitoring van patiënten (follow-up).

Effect van de inzet van praktijkondersteuners op patiënts voorkeur, tevredenheid en factoren die hierop van invloed zijn (hoofdstuk 7)

Aan een steekproef van patiënten, die in het laatste half jaar van de cluster-gerandomiseerde studie naar de praktijkondersteuners waren verwezen, is een vragenlijst toegestuurd die als doel had om de voorkeur van de patiënt voor de huisarts en/of de praktijkondersteuner, de tevredenheid met de zorg en de factoren die hierop mogelijk van invloed zijn in kaart te brengen (dwarsdoorsnede onderzoek). Dit onderzoek laat zien dat patiënten over het algemeen zeer tevreden zijn met zowel de zorg zoals geboden door de praktijkondersteuner als de zorg zoals geboden door de huisarts. Patiënten neigden iets meer tevreden te zijn met de zorg verleend door de praktijkondersteuner. Patiënten waren in het bijzonder meer tevreden over de communicatie, de steun en de begeleiding die ze van praktijkondersteuners ontvingen. Dit betekende niet dat patiënten ook de voorkeur geven aan zorg verleend door een praktijkondersteuner. Onze bevindingen suggereren dat de voorkeur afhankelijk is van de zorgbehoeften van de patiënt. Patiënten hebben een duidelijke voorkeur voor de huisarts als zij medische zorg nodig hebben, terwijl patiënten geen voorkeur hebben voor de huisarts of de praktijkondersteuner als zij routinematige zorg (veelal bij chronische ziekten), voorlichting, of steun dan wel begeleiding nodig hebben. De variatie in voorkeur en tevredenheid is het sterkst gecorreleerd met bepaalde patiëntkarakteristieken.

Factoren die succesvolle implementatie van praktijkondersteuners beïnvloeden (hoofdstuk 8)

In Nederland lijken een aantal factoren de implementatie van praktijkondersteuners te beïnvloeden. Dit zijn onder andere de volgende factoren:

- duidelijkheid over de taken en de verantwoordelijkheden van praktijkondersteuners;
- duidelijkheid over de patiëntgroepen waarvoor de praktijkondersteuners ingezet kunnen worden;
- continue bijscholing en supervisie van de praktijkondersteuners; en
- beschikbaarheid van een behandelkamer c.q. spreekuurkamer in de huisartsenpraktijk.

Verder dient men bij de implementatie rekening te houden met het feit dat alle leden van het team, werkzaam in de huisartsenpraktijk dat wil zeggen de huisarts(en), de praktijkassistente(n) en de praktijkondersteuner(s), tijd nodig hebben om aan elkaar te wennen en vertrouwen in elkaar te krijgen Vertrouwen is een voorwaarde om te komen tot een optimale inzet van praktijkondersteuners

Deel III Het effect van twee taakherschikkingsmodellen

Om de huidige wetenschappelijke kennis ten aanzien van de effecten van twee verschillende taakherschikkingsmodellen, te weten substitutie en supplementatie, in kaart te brengen is de internationale literatuur systematisch bestudeerd Bij substitutie is er sprake van het feitelijk overnemen van de taken van de huisartsen, met andere woorden de praktijkondersteuners voeren taken uit die voorheen door de huisartsen werden uitgevoerd Substitutie heeft als primaire doel het reduceren van de kosten van de gezondheidszorg Bij supplementatie is er naast het overnemen van taken ook sprake van het bieden van extra en of nieuwe zorg die complementair is aan de zorg die door de huisartsen wordt verleend Supplementatie heeft als primaire doel het verbeteren van de kwaliteit van de zorg en de patientuitkomsten

Substitutie het effect van het inzetten van praktijkondersteuners op patientuitkomsten, het zorgproces, de zorgconsumptie en de kosten van de zorg (hoofdstuk 9)

Zestien trials over substitutie zijn geincludeerd 13 gerandomiseerd gecontroleerde studies en drie gecontroleerde voor- en nametingstudies De studies zijn ingedeeld in drie categorieen

a) eerste contact en vervolgmanagment voor alle patientcategorieen (n=4),
b) eerste contact bij spoedeisende zorg (n=5), en
c) management van patienten met chronische aandoeningen (n=5)

Zes studies werden in Groot Brittannie uitgevoerd, zes in de Verenigde Staten en vier in Canada Met uitzondering van een studie (18 maanden follow-up), hadden alle studies een relatief korte follow-up periode (maximaal 1 jaar)

Meta-analyses waren voor een beperkt aantal studies en uitkomsten mogelijk In de meta-analyses werden alleen studies gericht op het management van patienten met chronische aandoeningen meegenomen De meta-analyses toonden aan dat in vergelijking met de huisartsen, de patienten meer tevreden waren met de zorg zoals geboden door praktijkondersteuners en dat de praktijkondersteuners meer geneigd waren de patient terug te zien (follow-up) Er werden geen verschillen gevonden tussen de praktijkondersteuners en de huisartsen ten aanzien van het aantal medicatievoorschriften en het aantal verwijzingen naar andere gezondheidszorgvoorzieningen zoals ziekenhuizen Semi-

quantitatieve analyses van de studies uit de twee overige categorieën lieten dezelfde tendensen zien. Slechts één op de vijf studies waarin kosten werden gemeten, liet een duidelijke kostenbesparing zien in het voordeel van substitutie. Het is onbekend of substitutie de werkdruk van huisartsen verminderd.

We concludeerden dat adequaat geschoolde verpleegkundigen op de in het onderzoek betrokken onderwerpen kwalitatief dezelfde zorg kunnen bieden als huisartsen en ook dezelfde gezondheidsresultaten bereiken. Substitutie heeft de potentie om de werkdruk van huisartsen te verminderen en de kosten van de gezondheidszorg te reduceren. In welke mate deze resultaten worden bereikt, is afhankelijk van de specifieke context waarin de verpleegkundigen worden ingezet en van veranderingen in de praktijkorganisatie en in de gezondheidszorg.

Supplementatie: het effect van het inzetten van praktijkondersteuners op patiëntuitkomsten, het zorgproces, de zorgconsumptie en de kosten van de zorg (hoofdstuk 10)

Tweeëndertig studies over supplementatie werden geïncludeerd: 25 gerandomiseerd gecontroleerde studies en zeven gecontroleerde voor- en nameting studies. De studies zijn verdeeld in twee categorieën:

a) preventieve zorg (n=15); en

b) management van chronische zieken (n=17).

De geïncludeerde studies zijn in zes landen uitgevoerd; de helft van de studies werd echter in Groot Brittannië uitgevoerd. De meerderheid van de studies had een relatief korte follow-up periode (maximaal 1 jaar). De methodologische kwaliteit van de studies varieerde van matig tot goed.

Meta-analyses konden voor een beperkt aantal studies en uitkomsten worden uitgevoerd. Uitkomsten die niet in meta-analyses konden worden meegenomen, werden semi-quantitatief geanalyseerd. De analyses laten zien dat supplementatie resulteert in een verbetering van de patiëntuitkomsten en van de kwaliteit van zorg voor zowel de preventieve zorg als de zorg voor chronische zieken.

Preventieve zorg: Het sterkste bewijs voor de toevoeging van verpleegkundigen aan het huisartsenteam (supplementatie) betrof een verbetering van zowel het herkennen als het registreren van risicofactoren, zoals hoge bloeddruk, hoog cholesterolgehalte, overmatige alcoholconsumptie en roken. In mindere mate zagen we ook een verbetering in de gezondheid van patiënten. Uitzondering hierop waren drie studies gericht op de preventieve zorg voor ouderen. In deze studies werd het aantal sterfgevallen significant gereduceerd. Het inzetten van praktijkondersteuners resulteerde niet in het beter uitvoeren van risicoverlagende interventies (zoals meer bewegen) door patiënten. De zorgconsumptie lijkt te zijn toegenomen, maar in veel gevallen was dit beoogd omdat de supplementatie tot

doel had dat patiënten meer gebruik zouden maken van specialistische zorgvoorzieningen, zoals begeleiding door een alcoholcounselor en hulp van de thuiszorg. Drie studies rapporteerden de kosten. Eén studie liet een reductie in initiële kosten zien, maar na 3 maanden was er sprake van een lichte toename in kosten. Twee studies concludeerden dat de korte termijn voordelen van screening van hart- en vaatziekten niet opwegen tegen de kosten van een dergelijke screening.

Management van chronische zieken: Supplementatie was geassocieerd met verbeterde zorg, resulterend in verbeterde risico-controle en zelf-gerapporteerde gezondheid en een verhoogde tevredenheid met de zorg. Dit kan op termijn leiden tot een vertraging in het ziekteproces en een reductie in het aantal sterfgevallen. Er was echter onvoldoende bewijs om vast te stellen of deze effecten ook daadwerkelijk optraden. Er was een schaarste aan informatie over de zorgconsumptie en de kosten-effectiviteit. Het aantal consulten en het aantal medicatievoorschriften leek echter niet te zijn toegenomen. Vier studies namen de extra kosten voor het aanstellen van praktijkondersteuners in overweging. Drie studies lieten een reductie in kosten zien, terwijl één studie een toename in kosten liet zien. Meer onderzoek is nodig om de extra kosten per levensjaar (QALY) te kunnen vaststellen. Of deze extra kosten gerechtvaardigd zijn, is afhankelijk van omgevingsfactoren en zal per locatie in overweging moeten worden genomen.

Algemene discussie

De belangrijkste bevindingen van dit proefschrift worden in hoofdstuk 11 samengevat en bediscussieerd. Dit proefschrift draagt bij tot de wetenschappelijke kennis op het gebied van taakherschikking in de eerstelijnsgezondheidszorg, in het bijzonder de inzet van praktijkondersteuners in de huisartsenpraktijk. We concluderen dat de praktijk-ondersteuners zowel taken van de huisartsen overnemen (substitutie) als extra zorg aanbieden, complementair aan de zorg van de huisartsen (supplementatie). Beide modellen zijn effectieve strategieën om de kwaliteit van de zorg te verbeteren. Patiënten staan positief tegenover de inzet van praktijkondersteuners. De praktijkondersteuners bereiken dezelfde gezondheidsuitkomsten, en soms zelfs verbeterde gezondheidsuitkomsten, in vergelijking met huisartsen. De praktijkondersteuners kunnen op vele terreinen worden ingezet, bijvoorbeeld als eerste contact voor spoedeisende zorg, in de preventieve zorg en in de zorg voor chronische zieken. Meer onderzoek is nodig om de effecten van taakherschikking op de werkdruk van huisartsen in kaart te brengen. Ook is meer onderzoek nodig om vast te stellen wat de optimale mix van zorgverleners en competenties in de huisartsenpraktijk is en wat de kosten-effectiviteit van deze veranderingen in teamsamenstelling zijn.

Dankwoord/Acknowledgement

"Veel mensen weten uit ervaring hoe moeilijk het is iets op te schrijven, waarvan je denkt dat weet ik wel Het zit in je hoofd, het ligt voor je gevoel helemaal klaar, je kunt er zelfs makkelijk over praten, het lijkt alleen nog maar een kwestie van de pen pakken en het staat er Maar met die pen in de hand komen de problemen "

(Rutger Kopland)

Ik heb reeds vele promoties bijgewoond en ik weet dat er nog vele zullen volgen. Iedere promovendus volgt zijn eigen traject. Sommigen gaan als een speer en anderen hebben meer tijd nodig voor het schrijven van hun proefschrift. Met 10 jaar behoor ik zeker tot de laatste groep en ik ben dan ook blij dat het eindelijk is afgerond. Nu alleen de verdediging nog.....

In dit proefschrift zijn de bevindingen van diverse studies tot een geheel gebundeld. Op het eerste oog lijkt het alleen mijn werk te zijn, maar schijn bedriegt. Zonder de steun, het vertrouwen, de begeleiding, de praktische hulp en de inhoudelijke kennis en expertise van anderen zou er nu geen proefschrift liggen. Een woord van dank is daarom op zijn plaats.

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Dear Bonnie, you are a wonderful person and supervisor. Words can't express my sincere appreciation, but I would like to try. I remember that Jeremy Grimshaw introduced me as a potential candidate who could help you with the Cochrane Review on skill mix changes. Although we had never met, I was offered the opportunity to join the review team

and to take the lead We met only a few times, but we had lots of e-mail contact Your ideas on skill mix changes profoundly influenced me and my learning process Furthermore, your careful scrutiny of the manuscripts and editorial corrections of my English enriched my work I would also like to thank you for introducing me to other researchers

Dit proefschrift zou zonder het project "De huisarts en de praktijkverpleegkundige in Midden-Brabant" niet tot stand gekomen zijn Ik dank alle praktijkverpleegkundigen, huisartsen en patienten (van wie ik de namen om privacy redenen niet zal noemen) voor hun medewerking aan het onderzoek Ook wil ik de DHV Midden Brabant (Patricia Brands, Maarten de Wit) en TheBe (Michel Wijngaards, Wim Corsten), de initiators van dit project, bedanken CZ Actief in Gezondheid en VGZ wil ik danken voor het feit dat zij dit project mede gefinancieerd hebben In het bijzonder dank voor Marieke van Schaijk, zij was de projectleider en een enorme steun voor de praktijkverpleegkundigen en huisartsen die deelnamen aan het project Marieke, je was onmisbaar voor het slagen van het project

David Reeves, your involvement in both reviews was of inestimable value I remember our discussions about whether or not to perform meta-analyses and how to deal with criticism for combining heterogeneous outcomes and studies You used the following metaphore for explaining your point of view *'There is still the potential that we could be criticised , as someone once said there may be nothing wrong in combining apples and pears if you want to say something about fruit!"* Evan Kontopantelis, you were also indispensable Before you could perform the meta-analyses and semi-quantitative analyses I think we exchanged at least a hundred e-mails to check, re-check and re-check again all the data I think I must have driven you crazy! Thanks for all your help, and perhaps we will meet in the future I also thank Steve Rose and Richard Heywood who advised on the original search strategy and helped with the computerised searches, Michelle Sergison who helped to design the review and assisted with early data extraction, and Shirley Halliwell who obtained the articles and helped to screen papers suitable for data extraction

Michel Wensing, ook jou ben ik dank verschuldigd Je bent in de laatste fase van mijn proefschrift, in het bijzonder bij de voltooiing van het supplemenation review, betrokken geweest Meer dan eens zei je dat het proefschrift niet perfect hoefde te zijn, maar dat het belangrijker was om het te voltooien Dit is een moeilijke boodschap voor iemand die de lat hoog legt en het liefst alleen maar "BMJ" artikelen zou opnemen in het proefschrift Ik ben je dankbaar dat je, ondanks je eigen drukke agenda, tijdens mijn ziekte en reintegratie taken van me hebt overgenomen en dat je me daarmee de kans hebt gegeven om mijn proefschrift af te ronden Zonder dat gebaar zou het proefschrift nu waarschijnlijk nog niet klaar geweest zijn

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Curriculum Vitae

Miranda Laurant werd geboren op 2 februari 1971 in Tilburg als jongste dochter van Albert en Riet Laurant. Gedurende haar lagere en middelbare schoolperiode woonden ze in Beneden-Leeuwen; een dorp gelegen in het land van Maas en Waal. In 1989 haalde zij haar HAVO-diploma aan het Pax Christie College in Druten. In hetzelfde jaar begon zij enthousiast aan haar verpleegkundige studie aan de HogeSchool Nijmegen (HBO-V). Nadat zij in 1993 haar verpleegkundig diploma had gehaald, begon zij met de verkorte studie Gezondheidswetenschappen aan de Universiteit Maastricht. Haar studie combineerde ze met werken in de zorg, vrijwilligerswerk bij de Gezondheidswijzer van de GGD Maastricht en in mei 1996 studeerde zij af in de richting Gezondheidsvoorlichting en -opvoeding. Haar afstudeerproject betrof de evaluatie van een lespakket over gezonde voeding voor kinderen op de basisschool. Dit project werd uitgevoerd in opdracht van het Voedingscentrum in Den Haag. Na haar afstuderen werkte ze tot april 1997 als wijkverpleegkundige bij de District Kruisvereniging Zuid-Gelderland.

In januari 1997 begon ze aan haar wetenschappelijke carriere. In 1997 heeft ze als onderzoeksassistente bij de afdeling Epidemiologie en afdeling Huisartsgeneeskunde van de Katholieke Universiteit Nijmegen gewerkt. In januari 1998 begon ze bij de WOK (tegenwoordig afdeling Kwaliteit van zorg, UMC St Radboud). In de eerste jaren had ze een gecombineerde functie: algemeen onderzoeksassistent op het programma 'MTA en richtlijnen implementatie' en junior onderzoeker op het project 'de huisarts en de praktijkverpleegkundige in Midden Brabant'. Dit laatste project vormde de basis van het promotie onderzoek waarover in dit proefschrift verslag wordt gedaan. Vanaf november 2000 werd zij volledig aangesteld als onderzoeker op diverse implementatie projecten. Vanaf maart 2001 is zij werkzaam als senior onderzoeker en is zij projectleider van de onderzoekslijn "kwaliteit van de (eerstelijns) geestelijke gezondheidszorg". Deze functie wordt tot op heden vervult.

Miranda woont sinds 1997 in Druten en is op 7 juni 2002 getrouwd met haar jeugdliefde Marc Geurts. Op 30 november 2004 werd hun zoon Tom geboren.

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Stellingen

DIT PROEFSCHRIFT

1. Het gevoel hebben dat de werkdruk is verminderd, betekent niet dat dit ook daadwerkelijk zo is.
2. Door het inzetten van praktijkondersteuners wordt de werkdruk van huisartsen niet minder.
3. Praktijkondersteuners bieden even goede zorg als huisartsen.
4. Patiënten geven de voorkeur aan de zorg van huisartsen, maar zijn tevredener met de zorg van praktijkondersteuners.
5. Een goede huisvesting, waarbij de praktijkondersteuner gebruik kan maken van een spreekuurkamer in de huisartsenpraktijk, is voorwaarde voor efficiënte inzet van de praktijkondersteuners.
6. Het inzetten van goedkopere professionals (bijv. praktijkondersteuners) is geen garantie voor een reductie in de kosten van de gezondheidszorg.

ALGEMEEN

7. Kennis is niet meer dan een mening die je voldoende vertrouwt om ernaar te handelen. *(Orson Scott Card)*
8. Elk weten komt uit ervaring. *(Immanuel Kant)*
9. Een argument wordt er niet sterker op, omdat men het uitschreeuwt. *(Fritz Franken)*
10. De wereld wordt niet bepaald door wat we zien maar door wat we over het hoofd zien. (*Jopie Huisman*)
11. De permanente veronderstelling dat na een drukke periode mogelijk een wat rustigere periode zal volgen is een illusie. *(onbekend)*
12. Voor het voltooien van een proefschrift is doorzettingsvermogen een belangrijkere factor dan intelligentie. *(onbekend)*

"Changes in skill mix. The impact of adding nurses to the primary care team"
Miranda Laurant, 11 december 2007