

ORIGINAL RESEARCH: EMPIRICAL RESEARCH –
QUANTITATIVE

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

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nurse practitioners in out-of-hours primary care: a quasi-experimental study.
Journal of Advanced Nursing 72(8), 1813–1824. doi: 10.1111/jan.12954**Abstract****Aim.** To provide insight into the impact of substituting general practitioners with nurse practitioners in out-of-hours services on: (1) the number of patients; and (2) general practitioners' caseload (patient characteristics, urgency levels, types of complaints).**Background.** General practitioners' workload during out-of-hours care is high, and the number of hours they work out-of-hours has increased, which raises concerns about maintaining quality of care. One response to these challenges is shifting care to nurse practitioners.**Design.** Quasi-experimental study comparing differences between and within out-of-hours teams: experimental, one nurse practitioner and four general practitioners; control, five general practitioners.**Methods.** Data of 12,092 patients from one general practitioners cooperative were extracted from medical records between April 2011 and July 2012.**Results.** The number of patients was similar in the two study arms. In the experimental arm, the nurse practitioner saw on average 16.3% of the patients and each general practitioner on average 20.9% of the patients. General practitioners treated more older patients; higher urgency levels; and digestive, cardiovascular and neurological complaints. Nurse practitioners treated more patients with skin and respiratory complaints. Substitution did not lead to a meaningful increase of general practitioners' caseload.**Conclusion.** The results show that nurse practitioners can make a valuable contribution to patient care during out-of-hours. The patients managed and care provided by them is roughly the same as general practitioners. In areas with a shortage of general practitioners, administrators could consider employing nurses who are competent to independently treat patients with a broad range of complaints to offer timely care to patients with acute problems.

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Why is this research or review needed?

- Nurse practitioners are considered to be a solution in the increased demand for out-of-hours primary care.
- Scientific evidence for substituting general practitioners with nurse practitioners is available for daytime primary care, showing it is safe and effective.
- There is no evidence about the effect of substitution of general practitioners by nurse practitioners in out-of-hours care.

What are the key findings?

- A team of four general practitioners and one nurse practitioner provides care to the same number and type of patients as a team of five general practitioners.
- Substitution has not led to a meaningful increase of general practitioners' caseloads (i.e. number and type of patients).
- More than 77% of the patients seen in out-of-hours primary care fit the scope of nurse practitioner practice.

How should the findings be used to influence policy/practice/research/education?

- Nurse practitioners can take over a substantial proportion of the caseload of general practitioners in teams of four general practitioners and one nurse practitioner.
- The ratio of one general practitioner and three nurse practitioners in a team might be possible. Results should be translated to countries' and states' specific rules for independent nurse practitioner practice.
- Future research should investigate the impact of substitution of general practitioners by nurse practitioners on healthcare costs.

Introduction

In the last decade, out-of-hours primary care has been reorganized in several Western countries in response to various challenges. These include a shortage of general practitioners (GPs), reduced motivation to provide 24/7 care and the increased number of primary care contacts taking place out-of-hours (Grol *et al.* 2006, Huibers *et al.* 2009). The workload for GPs during out-of-hours care is high, and the number of hours GPs work has increased. This raises concerns about maintaining quality of care. One possible response to these challenges is shifting care from GPs to

nurse practitioners (NPs). NPs have demonstrated their ability to do part of GPs' work in daytime primary care. NPs have the knowledge, competencies and complex decision-making skills for an expanded practice (Horrocks *et al.* 2002, Dierick-Van Daele *et al.* 2009, Sangster-Gormley *et al.* 2011, Vrijhoef 2014). However, the implications of substitution in an out-of-hours service are unknown. Is it possible to substitute a GP with an NP in a team of GPs and what is the effect on the number and characteristics of patients (i.e. caseload) of the other GPs? This study contributes to the evidence base of substitution of care by nurses, with a particular focus on out-of-hours care.

Background

Many Western countries are seeking an efficient and safe model to deliver out-of-hours health care for patients. In the Netherlands, United Kingdom and Denmark, the most common model for delivering out-of-hours primary care is large-scale General Practitioners Cooperatives (GPCs) (Huibers *et al.* 2009). In other countries, such as Germany, large-scale services are currently emerging. In the Netherlands, 40-250 GPs, depending on the number of patients in the region, take turns at being on duty from 5 pm - 8 am on weekdays and the entire weekend. They take care of populations ranging from 100,000 - 500,000 citizens. This model of care has many positive aspects (Giesen *et al.* 2011b), but it still struggles to comply with the rising demand for out-of-hours care (Huibers *et al.* 2011). This demand is increasing internationally in both out-of-hours primary care and the emergency department (ED) (Tang *et al.* 2010, Giesen *et al.* 2011b, Margolius & Bodenheimer 2011).

Due to the rising demand for out-of-hours primary care and the anticipated future shortage of GPs, the pressure on GPs is expected to increase even more during the next few years (Freund *et al.* 2015). If nothing is done, issues concerning the quality, accessibility and efficiency of out-of-hours care are inevitable. Since most consultations during out-of-hours are neither complex nor urgent (Giesen *et al.* 2005, 2011a, Huibers *et al.* 2011), shifting care from GPs to nurses is one solution being considered to address these challenges (Horrocks *et al.* 2002, Sibbald *et al.* 2004, Martinez-Gonzalez *et al.* 2014). Deploying NPs as professional

substitutes for GPs is also interesting since it enhances opportunities for education and job opportunities for nurses. This might improve retention for the nursing workforce (Buchan *et al.* 2015, Kroezen *et al.* 2015, Poghosyan *et al.* 2015). The deployment of NPs in primary care is observed internationally, but the speed of the process differs between countries and sometimes even between states and regions (Naylor & Kurtzman 2010, Vrijhoef 2014, Freund *et al.* 2015).

Research on NPs in daytime primary care shows they can substitute for a GP in the management of patients with minor health problems and that both disciplines provide comparable care (Horrocks *et al.* 2002, Dierick-Van Daele *et al.* 2009, Martinez-Gonzalez *et al.* 2014). Although the number of rigorous evaluations remains low, systematic reviews suggest that doctor–nurse substitution in primary care is associated with higher patient satisfaction, lower overall mortality and fewer hospital admissions. Nurse-led care has proven to be both effective and safe, although not necessarily less expensive (Horrocks *et al.* 2002, Laurant *et al.* 2005, Martinez-Gonzalez *et al.* 2014). In addition, research in emergency care shows that NPs provide a valuable, safe and effective service (McDevitt & Melby 2015, McDonnell *et al.* 2015, Pirret *et al.* 2015).

Despite these studies, questions remain about whether and for what kind of care an NP can substitute for a GP in an out-of-hours primary care setting. Although the numbers of NPs working in (out-of-hours) primary care are low in most countries, there are also (mostly rural) regions where the NP is the primary source for patient care (Everett *et al.* 2009, Freund *et al.* 2015). Evidence about the deployment of NPs in out-of-hours is lacking. Whereas during daytime patients more often present chronic complaints, patients during out-of-hours more often present acute problems and infectious diseases (Giesen & Braspenning 2004). Not only is research important because out-of-hours care differs from care during daytime but also because the competencies of NPs are not well defined in most countries. Roles are usually based on education, scope of practice and complexity of complaints and differ between countries, between states or regions, and between organizations (Arizona BON 2009, Kleinpell *et al.* 2012, Poghosyan *et al.* 2015). For example in the Netherlands and 12 other European and Anglo-Saxon countries, there is a legal basis for independent prescribing of medication and other procedures by NPs. However, authorities differ from prescribing independently to prescribing only under strict conditions and the supervision of physicians (Plonczynski *et al.* 2003, De Bruijn-Geraets *et al.* 2014, Kroezen *et al.* 2014). Despite the international

differences in scope of practice of NPs, we need more insight into the possibilities of substituting GPs with an NP in out-of-hours primary care and the implications of this model of healthcare delivery so that the further implementation of NP roles can be guided appropriately.

The study

Aims

The aim of this study was to assess the effects of substitution of care from GPs to NPs in an out-of-hours primary care setting. We looked at the number of patients treated at the GPC when in a team of five GPs one GP was substituted by an NP. Our focus was the number of patients treated by the NP. We documented the type of patients that were treated, to what extent they matched the predefined scope of the NPs' competencies (see Box 1) and the impact on GPs' caseload.

Design

A quasi-experimental study was conducted at a general practitioners cooperative (GPC) in the southeast of the Netherlands (Wijers *et al.* 2012). In the experimental arm, a team of one NP and four GPs provided patient care, whereby the NP substituted one GP. In the control arm, patient care was provided as usual by a team of five GPs. The unit of allocation was weekend days between 10 am and 5 pm. The experimental and control days were determined in advance and followed a 5-week rotation scheme. Days rotated between Saturday and Sunday to avoid bias due to possible differences in patient presentations on those weekend days.

Box 1

Predefined scope of NP care

Excluded from NP care:

- Patients younger than 1 year;
- patients suffering from psychiatric complaints;
- patients suffering abdominal pain, chest pain, neck ailment, headache or dizziness.

Patients who fit the predefined scope of NP care:

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

Sample/participants

Patients

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

In both the experimental and the control arm, up to four patients were scheduled every 10 minutes in the common presentation list (Wijers *et al.* 2012). This was done either by the triage nurses at the call centre or at the front office of the GPC. Patient allocation in the experimental arm to either a GP or NP did not occur randomly or blindly because the professionals chose their own patients from the presentation list based on the complaints presented. Random allocation of patients to an NP or a GP would have interfered with the daily routine.

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

Nurse practitioners

Five NPs were recruited for the study. They had all followed a 2-year master's programme called 'higher professional education master's degree in advanced nursing practice' (MANP). Their programme included an academic course on treating common complaints in primary care and an internship in general practice (Dierick-Van Daele *et al.* 2009, Freund *et al.* 2015).

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

introduction at the GPC during which they worked directly with a GP.

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

General practitioners

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

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

Measures

Outcomes

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

Electronic medical records

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

Ethical considerations

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

Data analysis

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

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

formed to compare patient characteristics between NPs and GPs in the experimental arm.

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

Validity and reliability

Data collection

A retrospective medical record review was performed to obtain patient characteristics and information about the consultations. All data related to the care and diagnostics were registered by the healthcare providers themselves during the consultation. This registration of diagnosis and treatment activities in the medical record was comparable to those of other medical records that are considered to be valid and reliable (Visscher *et al.* 2012, Olthof *et al.* 2013).

Data analysis

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

Table 1 NTS urgency levels (Van Ierland *et al.* 2011).

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

Results

Recruitment

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

Outcomes

Number of patients

In total, 12,092 patients had a consultation during the study period. In the experimental arm, 987 patients visited an NP and 5053 patients visited a team of four GPs. In the control arm, 6052 patients visited a team of five GPs.

This shows that in the experimental arm, the NP saw 16.3% of the attending patients, whereas the four GPs saw on average 20.9% of the patients each. This implies 15.7 patients per NP vs. 20.1 patients per GP on experimental days. On control days, GPs treated on average 19.2 patients each.

Comparison of patient characteristics

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

In the experimental arm, significant differences were found between GPs and NPs for age ($P = 0.002$), urgency level ($P < 0.001$) and type of complaint ($P < 0.001$). There

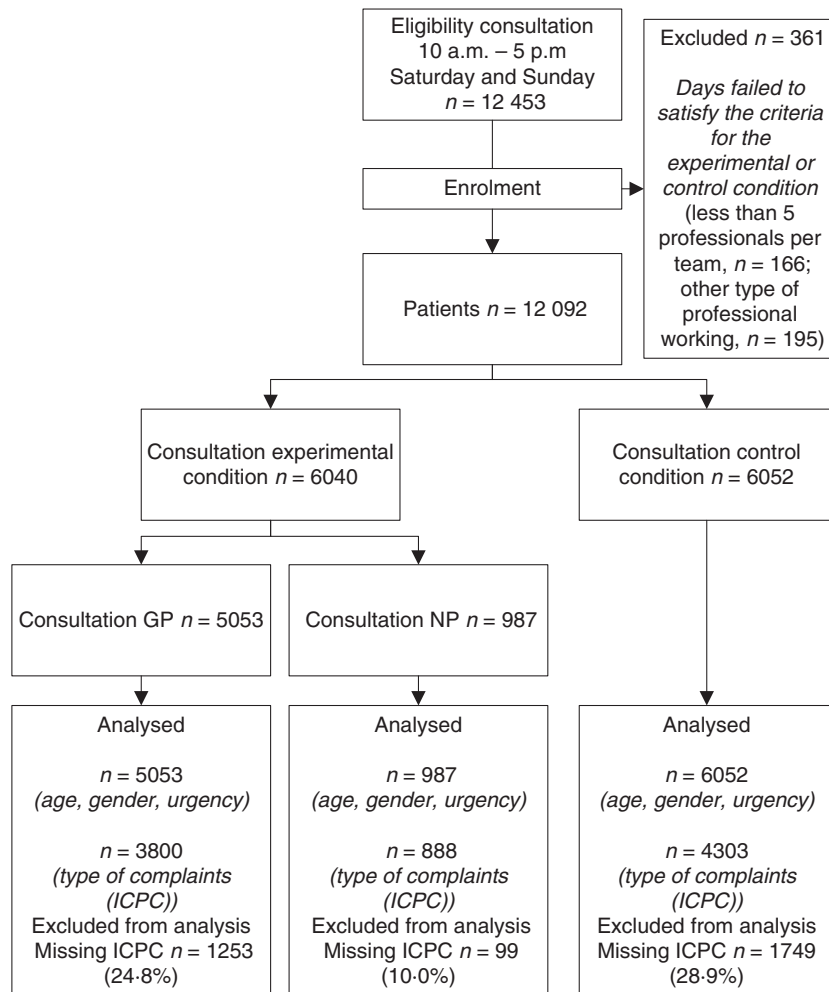


Figure 1 Flowchart of the study.

were more patients aged 2-17 years in the NP group and more patients older than 64 years in the GP group. Moreover, GPs in the experimental arm saw a larger proportion of patients with complaints at an urgency level of U2, whereas the proportion of patients with an urgency level of U4 was higher in the NP group. Finally, in the NP group, more patients had skin and respiratory complaints than in the GP group. In the GP group, there were more patients with eye, digestive, cardiovascular or neurological complaints.

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

As shown in Table 2, no significant differences were found in patient characteristics between GPs in the experimental arm and GPs in the control arm. Table 3 shows that in both arms, roughly 77.5% of patients fitted the predefined scope of the NP. Consequently, 25.1% of GPs' patients in the experimental arm were patients with a complaint that was excluded for NP care, compared with 22.7% in the control arm ($P < 0.001$) (Table 4). Results from Table 2 indicate that NPs did occa-

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

	Control arm (n = 6052)	Experimental arm (n = 6,040)	GP experimental arm (n = 5,053)	NP experimental arm (n = 987)
Age (mean years [SD])	34.02 (24.4)	33.99 (24.94)	34.33 (25.1)	32.25 (23.9)
Age in categories (%)*				
0-1 year	8.2	8.7	9.0	7.3
2-17 years	21.6	21.6	22.3	25.6
18-64 years	56.4	54.1	53.8	55.6
65 years and older	13.9	14.4	15.0	11.4
Gender (% male)	46.4	47.6	46.9	51.4
Urgency (%)*				
U1	0.1	0.1	0.1	0.0
U2	7.9	8.4	9.5	2.4
U3	48.2	47.3	47.4	47.0
U4	38.4	38.7	37.6	44.4
U5	5.4	5.5	5.4	6.2
	Control arm (n = 4303)	Experimental arm (n = 4688)	GP experimental arm (n = 3800)	NP experimental arm (n = 888)
Complaints (%)*				
Skin	21.7	22.7	20.7	31.2
Musculoskeletal	20.5	20.1	19.6	22.2
Respiratory	15.2	14.2	13.7	16.3
Ear	5.7	5.8	5.6	6.8
General and unspecified	5.9	6.5	6.6	6.0
Urological	5.5	5.7	5.7	5.6
Eye	6.0	6.1	6.5	4.4
Female genital	1.0	1.0	1.1	0.8
Pregnancy, childbearing, family planning	0.7	0.6	0.6	0.7
Male genital	0.6	0.8	0.9	0.6
Endocrine/metabolic and nutritional	0.6	0.7	0.7	0.5
Social problems	0.2	0.2	0.2	0.3
Blood, blood forming organs and immune mechanism	0.3	0.2	0.2	0.2
Digestive	10.5	9.9	11.4	3.0
Cardiovascular	2.5	2.5	2.9	0.7
Psychological	0.9	0.7	0.8	0.5
Neurological	2.3	2.3	2.8	0.3

Tested using a χ^2 test, Bonferroni-adjusted significance level of 0.0042.

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

sionally see patients excluded for NP care, like digestive (3.0%), psychological (0.5%) and neurological complaints (0.3%) and children younger than 1 year old (7.3%).

Discussion

First, we found no effect of substitution on the number of patients attending the GPC. We found that GPs in the experimental arm each saw slightly more patients than the NPs did. Although this might be due to the predefined scope of the NPs, longer consultation times for NPs is in line with previous studies both in primary care and the ED (Hollinghurst *et al.* 2006, Dierick-Van Daele *et al.* 2009, Laurant *et al.* 2009, McClellan *et al.* 2013). Consequently, the GPs in the experimental arm saw slightly more patients than GPs in the control arm, although due to the small number this did not affect GPs' workload. This difference in number of patients may become more relevant when the ratio GP–NP changes.

As expected, we found that in the experimental arm patients seen by NPs demonstrated somewhat different complaints from those seen by GPs. Patients who visited an NP more frequently presented skin, musculoskeletal or respiratory complaints. Patients younger than 1 year or older than 64 years and patients with eye, neurological, digestive or cardiovascular complaints were more frequently seen by a GP. These differences are explained given the fact that older patients and the patients in the ICPC groups 'neurological', 'digestive' and 'cardiovascular' more often present complaints of abdominal pain, chest pain, a neck ailment, headache or dizziness, which were excluded from NP care. Occasionally, the NP treated patients suffering from the excluded complaints. Reasons to explain this practice may include the initial complaint differing from the actual ICPC code, for example, due to an inappropriate telephone triage (Huibers *et al.* 2012), or the NP having experience with a certain patient category, in particular treating young children aged 0-1 years. The urgency level of patients in the GP group

Table 3 Total number of patients who fit the predefined scope of NP care in the experimental and control arm*.

N (%)	Patients who fit the predefined scope of NP care	
	Yes	No
Intervention day (n = 4688)	3638 (77.6%)	1050 (22.4%)
Control day (n = 4303)	3326 (77.3%)	977 (22.7%)

Tested within a logistic regression analysis corrected for weekend day.

*No significant differences found.

Table 4 Patients excluded from NP care who were seen by GPs in the experimental and control arm.

N (%)	Patients excluded from NP care*	
	Yes	No
GP intervention day (n = 3800)	952 (25.1%)	2848 (74.9%)
GP control day (n = 4303)	977 (22.7%)	3326 (77.3%)

Tested within a logistic regression analysis corrected for weekend day.

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

was higher than it was in the NP group. This difference can be explained by the fact that digestive, cardiovascular and neurological complaints often have a higher urgency level.

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

Overall, the most common complaints we saw during out-of-hours care were skin, musculoskeletal, respiratory, digestive and general and unspecified complaints. These complaints, with the exception of digestive complaints, all fall within the scope of NP care. These prevalence rates of ICPC groups and the large number of patients presenting non-urgent complaints are comparable to those found in other out-of-hours services in Western countries (Den Boer-Wolters *et al.* 2010, Giesen *et al.* 2011b, Huibers *et al.* 2011). This makes the results generalizable to other out-of-hours primary care settings.

Although the results concur with studies conducted in primary care during daytime, this does not mean that they are simply generalizable to daytime care. A study during daytime reported that most complaints treated by NPs were related to conditions of the skin, throat, nose, ears or the respiratory or musculoskeletal systems (Dierick-Van Daele *et al.* 2009). These results are consistent with the results we obtained in terms of ICPC groups. Nevertheless, the complaints (i.e. ICPC codes) were different. For example, skin conditions presented during daytime primary care mainly included acne,

eczema, warts and rash, whereas in our study, lacerations, scalds, skin infections, insect bites and bruises occurred more often. This difference can be explained by the fact that the out-of-hours service is for acute complaints, whereas during daytime primary care, patients more often visit an NP because of common, non-acute complaints.

It is important to stress that the NP profession does not solely serve as an extension of GPs' care. Instead, their knowledge and expertise (such as an holistic nursing approach and supporting self-management in patients) offers additional benefits for primary care services (Poghosyan *et al.* 2012, Sustaita *et al.* 2013, Carryer & Yarwood 2015). How to use NPs to their full potential is still a matter of political and organizational exploration worldwide (Poghosyan *et al.* 2015). This question is, however, beyond the scope of this study. The way out-of-hours primary care is organized in the Netherlands – together with eight other Western countries where the GPC is the dominant organizational model – provides a good example internationally how out-of-hours care could be organized (Huibers *et al.* 2009). In this study, we did not change the out-of-hours care model, but deployed the NP as substitutes of GPs. This is because primary care out-of-hours services still face difficulties with the rising number of patients demanding care when daytime surgeries are closed. Innovations to comply with the increasing demand in out-of-hours care are observed internationally. There are new models such as an emergency care access point (ECAP) for out-of-hours emergency care where triage determines whether patients will be seen by a GP or by a physician in the emergency department. Although this model enhances the efficiency of emergency departments, it increases the number of patients receiving a consultation at the GPC (Thijssen *et al.* 2013). Also other models, like emergency nurse practitioner service for patients with minor injuries, are implemented and although promising rarely evaluated (McDevitt & Melby 2015). These developments fuel the need for more evaluation of NPs offering out-of-hours care.

Strengths and limitations

A strength of this study is its relatively large patient sample and the generalizability in terms of ICPC groups. A limitation of the study is that it was conducted at one GPC with a small group of NPs ($n = 5$). Consequently, the generalizability to a larger population of NPs and other GPCs is not yet clear. The NPs all volunteered to participate in the study to give an extra boost to their profession. Their motivation might have influenced their work attitude and therefore the results. Another limitation may be that although the NPs all had at least 5

years of professional experience, none of them had previously worked at the GPC prior to this study.

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

We followed the normal procedures of the GPC where professionals choose their own patients from the presentation list. Another possibility was triage by nurses who perform the telephone triage at the call centre (Wijers *et al.* 2012). However, not only would this be less efficient, it would also impact the NPs' authority as professionals who can make their own clinical decisions. The pragmatic design was, therefore, an accurate representation of daily practice. Patients were not informed in advance about whether it was an experimental or control day or whether they were going to receive treatment from an NP or GP. Also GPs did not know in advance whether they would work on an experimental or control day, and so this did not influence their choice to either work or decline a shift at the GPC.

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

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

Finally, this study shows the effect of the NP in this particular Dutch setting. However, the education and deployment of NPs differ between and even within countries and healthcare systems (Coombs *et al.* 2007, Pulcini *et al.* 2010, Kroezen *et al.* 2011, Iglehart 2013, Vrijhoef 2014, Freund *et al.* 2015). In countries like the United States, Canada and Australia, the NP role in primary care is well developed. However, in most countries, the NP's role is relatively new or non-existent. The growing interest in NPs

stresses the need for clarifying the scope of NP practice and more research from different countries. That would enable cross-country comparison and a collective understanding of global challenges (Coombs *et al.* 2007, Kleinpell *et al.* 2012, Vrijhoef 2014). Since patient characteristics in this study are consistent with those shown in out-of-hours primary care in other Western countries, the results can be translated to countries' own specific rules and regulations concerning the NP's scope of practice.

Conclusion

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

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Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

All authors have agreed on the final version and meet at least one of the following criteria [recommended by the ICMJE (<http://www.icmje.org/recommendations/>)]:

- substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- drafting the article or revising it critically for important intellectual content.

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