Patient characteristics and health consumption of patients at three months follow-up visiting either the Advanced Nurse Practitioner or the General Practitioner in primary care.

B.A. Baar

5649684

Concept research thesis

28-6-2018

Clinical Health Sciences, Nursing Science program, Utrecht University

Supervisor: dr. N. Bleijenberg

Tutor: dr.J.M. de Man-van Ginkel

Hogeschool Utrecht, Utrecht

Leidse Rijn Julius Gezondheidscentra, Utrecht

Abstract

Background: more patients with increased complexity in primary care are caused by substitution from secondary to primary care, more elderly and more chronically ill patients. One of the interventions to keep the primary care effective might be the deployment of Advanced Nurse Practitioner's (ANP's). However, little is known about the impact of the ANP in primary care on healthcare consumption in the Netherlands.

Aim: To explore and compare patient characteristics and healthcare consumption of primary care patients visiting either the ANP or the General Practitioner (GP) at three months follow-up.

Method: A quantitative, observational prospective cohort study has been conducted at three Dutch primary care practices from July 2017 till January 2018. Patients who had initially been treated by an ANP or GP were followed-up for three months for their healthcare consumption with electronic routine care data. A joint ANP-GP relative frequency diagnostic code distribution has been performed to include patients within the ANP scope-of-practice. Differences in number of re-consultations and referrals to other healthcare providers between the ANP and GP group have been tested by Mann-Whitney U tests at the 0.05 alpha level.

Results: 1303 patients visited an ANP and 6580 patients a GP, which, after performing the selection method, resulted in 865 ANP and 3684 GP patients. Results showed that the ANP group was younger and had less multimorbidity compared with the GP group. No difference in re-consultations was found, but ANP's performed more home-visits (0.05 vs 0.014) and wrote fewer referrals (0.03 vs 0.06).

Conclusion: Patients who are visiting the ANP have different characteristics, are receiving the same number of re-consultations at three months follow-up, but receive fewer referrals compared to GP patients.

Recommendations: Further research should focus on the association between different patient characteristics and healthcare consumption and to the ideal ANP:GP ratio in primary care.

Keywords: Advanced Nurse Practitioner, General Practitioner, Primary Care, Healthcare consumption, Healthcare Utilization

Samenvatting

Titel: De karakteristieken en zorgconsumptie van patiënten na drie maanden follow-up welke de verpleegkundig specialist of de huisarts bezoeken in de eerste lijn.

Achtergrond: Er komen meer patiënten met hogere complexiteit in de huisartsenpraktijk door substitutie van de tweede naar de eerste lijn, meer kwetsbare ouderen en meer chronisch zieke patiënten. Eén van de interventies om de eerstelijns zorg efficiënt te houden kan implementatie van Verpleegkundige Specialisten (VS) zijn. Er is echter weinig bekend over de impact van de VS op eerstelijns zorgconsumptie in Nederland.

Doel: Het verkennen en vergelijken van patiënten karakteristieken en zorgconsumptie van eerstelijns patiënten welke de VS of huisarts bezoeken in drie maanden follow-up.

Methode: Een kwantitatief observationele, prospectieve cohort studie vond plaats in drie Nederlandse gezondheidscentra. Bij patiënten welke aanvankelijk door een VS of huisarts zijn gezien, zijn na drie maanden hun zorgconsumptie uit routine zorgdata onttrokken. Met behulp van een VS-huisarts diagnosecode relatieve frequentie distributie zijn de patiënten binnen de doelgroep van de VS te geïncludeerd. Verschillen in aantal consulten en verwijzingen tussen de VS en huisarts patiënten zijn getest met behulp van de Mann-Whitney U test met een 0.05 alpha.

Resultaten: 1303 patiënten bezochten een VS en 6580 patiënten een huisarts, na de selectie methode zijn er 865 VS en 3684 huisarts patiënten geïncludeerd. Patiënten in de VS groep waren significant jonger, vaker vrouw en hadden minder vaak multimorbiditeit. Er is geen verschil gevonden tussen het aantal re-consultaties, maar wel een verschil in aantal visites en verwijzingen. De VS groep ontving vaker visites (0.06 vs 0.03) en minder vaak verwijzingen (0.05 vs 0.014).

Conclusie: Patiënten die de VS bezoeken hebben andere karakteristieken, krijgen evenveel consulten in drie maanden, maar ontvangen minder verwijzingen dan patiënten die de huisarts bezoeken.

Aanbevelingen: Meer onderzoek moet gedaan worden naar de relatie tussen patiënten karakteristieken en zorgconsumptie en naar de ideale VS: huisarts verhouding in een eerstelijns praktijk.

Kernwoorden: Verpleegkundig Specialist, Eerste Lijn, Huisarts, Zorgconsumptie, Gezondheidszorg Gebruik

Introduction

The current Dutch high-quality primary healthcare is at risk. In comparison with other European countries, the Dutch General Practitioner (GP) works more hours, performs more home-visits and spends a lot of time on non-direct patient care.[1,2] More substitution from secondary to primary care, more patients with chronic illnesses and more community-dwelling vulnerable elderly are causing more patients with higher complexities at the GP practice.[1–4] This leads to a high workload and is not sustainable.[4] One of the interventions to keep the primary care efficient and effective might be the deployment of Advanced Nurse Practitioners (ANP's).[5,6] ANP's are registered nurses with a Master's degree who provide medical expertise with complementary excellent nursing care in their specialism. Worldwide most primary care ANP's are working 'scope-based', having a broad focus on the entire primary care population and collaborate closely with physicians for care that is outside of their expertise.[7,8] Although the number of ANP's in the Netherlands is growing, from the introduction of ANP's in the Netherlands in 2005, still only ten percent of the Dutch ANP workforce is currently working in the primary healthcare practices.[9]

Systematic scientific evaluation of ANP roles is vital to support the further ANP implementation process and emphasize the ANP's contribution to patient outcomes.[10] Patient outcomes of ANP care are the result of ANP role structures and processes and should include ANP sensitive outcomes.[10–12] Previous research has shown that primary care ANP's are delivering safe, high-quality care[13–18] with good patient satisfaction[16–23]. However, literature provides conflicting evidence about healthcare consumption and resource use of ANP's in primary care and this may hinder further implementation.[13,24] Previous studies show evidence of fewer resources and costs,[17,25] evidence of equal healthcare consumption,[18,23] and evidence of equal to more healthcare consumption compared to GP provided care.[16,17,25]

Previous Dutch research studied the impact of primary care ANP's on the quality of care, health status, and short-term two-weeks healthcare consumption, all with no differences in care provided by the ANP or GP.[14,23,25,26]. The impact of ANP-care on long-term healthcare consumption at primary care patients in the Netherlands remains unknown. This gap of knowledge may hinder the implementation of primary care ANP's.[27]
There are many definitions of healthcare consumption who include different levels of health economics. Healthcare consumption in this research will be defined as the number of patient's contacts with the general practice team like the GP, ANP, practice nurse or practice assistant and the number of referrals to other healthcare providers the patient receives. This research will add knowledge to describe and compare the patient characteristics of ANP's

and GP's and explores the ANP's impact on patient healthcare consumption at three months follow-up. Based on previous research the expectation is that ANP's will treat less complex illnesses and therefore their patients will have different patient characteristics compared to patients in the GP group and that no difference will be found in healthcare consumption at three months follow-up.

Objective

Primary aim

To explore and compare the patient characteristics and healthcare consumption outcomes of patients visiting either the Advanced Nurse Practitioner or the General Practitioner in primary care at three months follow-up.

Secondary aim

To explore the most prevalent diagnostic codes, based on the ICPC system, at primary care patients seen by the Advanced Nurse Practitioner in comparison with the General Practitioner.

Method

Study design

This study is a quantitative, observational, prospective cohort study with an explorative approach and three months follow-up. Data has been prospectively collected and is derived from electronic routine primary care data. The association of healthcare consumption when patients are visiting a different healthcare provider will be studied in a prospective cohort. This design suits the aim, as the risk factor (healthcare provider) is applied and collected prior to the outcome (healthcare consumption).[28] The design will also be longitudinal because the number of re-consultations during the three months follow-up will be added together.[29,30]

Study population, sample and setting

This study was conducted at the Julius Health Centers in Utrecht, the Netherlands, at an academic primary healthcare organization with five healthcare centers. Three healthcare centers employ an ANP, one per center. These centers' patients who visited an ANP or GP during the inclusion time were included in this study. All primary care patients of all ages with all health conditions that are eligible for treatment by an ANP were included. Patients requesting for a consultation are triaged by practice assistants to grade the urgency of the request and to manage workload. The practice assistant also selects the, according to the practice local agreements, eligible patients for the ANP or GP. The local agreements on what illnesses the ANP sees are based on local needs, education, and experience of the individual ANP.

In general, ANP's in primary care are seeing patients with single or less complex medical illnesses or advanced, more complex nursing problems. All patients who have had any kind of consultation with an ANP or GP during the study period were included.

The following inclusion criteria have been applied; patients 1) visited an ANP or GP between 3 July – 20 October 2017 and 2) have a consultation record with a diagnostic code, International Classification of Primary Care (ICPC), written in their patient file.[31] Exclusion criteria were 1) not permanent subscribed general practice patients and 2) patients without a full three month follow-up period due to deregistration.

Variables

Patient characteristics

Patient characteristics have been calculated twice. First for all patients that met the inclusion criteria and, secondly, for all included patients after the selection method to predominantly include patients within the ANP scope-of-practice. They have been calculated twice to

compare if the patient characteristics changed after only the patients within the ANP scope-of-practice were selected. Patient characteristics have been displayed separately per healthcare provider to gain insight into which patients with which characteristics visited an ANP or GP. All patients' characteristics have been extracted from the electronic health records. It included age (years), sex (male/female), polypharmacy (presence of ≥5 chronic medicines)[32], chronic illness (yes/no)[33] and multimorbidity (presence of ≥2 chronic conditions)[34].

Most prevalent diagnostic ICPC codes

In the Netherlands, most GP's are administering their medical files by using the ICPC system.[31] ICPC is a classification method for primary care that has been developed by the World Organization of Family Doctors to order and classify the primary care data.[31] The patient's first consultation during the inclusion period has been identified and marked as 'index-consultation'. From all total recorded index-consultations, the ICPC diagnostic code has been extracted and compared to gain insight into the most prevalent ICPC-codes seen by both professions.

Healthcare consumption

Healthcare consumption has been operationalized by the number of primary care re-consultations and by the number of referrals to other healthcare providers at three months following the patients index-consultation.

Primary care consultations have been divided in consultations with the general practice or with the out-of-office GP service. Consultations with the general practice have been divided by consultations at the practice, at the telephone, home-visits, and e-mails. Follow-up consultations include all contacts with any healthcare provider at the GP practice, such as the GP, ANP, practice nurse or practice assistant. All healthcare provider's follow-up contacts are recorded, regardless of who performed the contact, because an initial health problem can result in various consultations with various healthcare providers.

The number of referrals to other healthcare providers in the follow-up period such as the Emergency Department, secondary policlinic care, and paramedical care were also extracted and added together.

Procedures

From electronic health records, a coded database with a 7-months full sample of all registered patients at the general practices at the study sites has been extracted by the health record ICT supplier. The data included, at patient's level, dates of contacts and contact type, employee code per contact, current and previous episodes of care, medicine

status (classified in temporarily, potential and chronic), referral register, date of birth and sex. The first consultation, regardless of what kind, with an ANP or GP between 3 July 2017 and 20 October 2017 has been identified and marked as 'index-consultation'. The index-consult served as classification point to classify a patient in the ANP or GP group. All types of patients' contacts with the healthcenter and therefore all healthcare consumption at three months following the individual patients initial index-consultation were extracted. A three months follow-up period has been considered to be a good timeframe to include both the acute phase and the long-term healthcare consumption.[35] In order to be able to compare the healthcare consumption and patient characteristics of patients within the ANP scope-of-practice, a selection procedure has been executed. Firstly, the patients' ICPC index-consultation codes have been extracted. A joint relative frequency distribution has been made with an ANP:GP ratio of 2:1, to be able to predominantly include patients with codes within the ANP scope-of-practice. This method has been combined with a minimum of three patients per diagnostic code and healthcare provider. Codes and therefore patients below this minimum were excluded. This procedure was necessary because GP's probably see patients with more complex illnesses and, consequently, their patients will have higher healthcare consumption. With this procedure, the severity of illnesses will be more comparable in both groups in order to determine a valid outcome. Once the definite patient sample has been selected their healthcare consumption at three months follow-up has been extracted from the database.

Data analysis

The routine care data has been transformed when needed and all variables and their distribution have been evaluated if the assumptions for the statistical tests were met. Descriptive statistics with the mean, Standard Deviations (SD) and percentages, or in case of skewed data the Median and Range have been used to display the patient baseline characteristics.

Any possible differences in patient's baseline characteristics between the ANP and GP group were tested with Mann-Whitney U tests for continues variables (age, chronic morbidities) and Chi-square tests for categorical variables (sex, polypharmacy, multimorbidity), both at the 0.05 alpha level. To test the difference in healthcare consumption between the ANP and the GP group, a two-sided independent Mann-Whitney U test with a 0.05 alpha has been used. All statistical testing has been performed with IBM SPSS Statistics version 25.0 (Armonk, New York, USA).

Ethical issues

This study has been conducted according to the principles of the Declaration of Helsinki (Version 8, 2013)[36] and in accordance with the Good Clinical Practice Guideline.[37] There has been no informed consent requested because this routine care data research was coded by medical file number and has been covered by the Law on Medical Treatment Agreement (WGBO).[38] All data were handled according to the Dutch Personal Data Protection Act and have been stored at a secured disk.[39] Data will be stored for ten years after publication.[40]

Missing data

As the used electronic programme for the medical files requires certain minimum standards for saving and automation there were no missing data. Other, at first, missing data included no ICPC-codes at some consultations. However, all consultations are connected with a diagnostic episode of care ICPC-code. Therefore these codes could be imported to resolve these missing values.

Results

Participants

During the study period, the three healthcare centers employed three ANP's (2.1 FTE) and 15 GP's (8.2 FTE). The ANP's had a mean of two (range 0-5) years of experience and the GP's a mean of 9.2 (range 0-30) years of experience. From the 22160 registered patients in the three healthcare centers, 7883 patients (35.6%) had a consultation with the ANP or GP during the inclusion period,1303 patients (16.5%) visited an ANP and 6580 patients (83.5%) visited a GP.

After the selection method to include patients within the ANP scope-of-practice 4549 (64.4% of total eligible patients) could be included and followed-up for three months. From these 4549 patients, 865 visited an ANP and 3684 visited a GP, see figure 1 for a schematic flowchart.

Patient characteristics

Before the selection method, so with also patients outside the ANP scope-of-practice, there were significant differences for gender and age in all age groups (table 1). In the ANP group, patients were more often female and were younger compared to patients in the GP group. Age was stratified and displayed into seven, in general health common, categories (figure 2). Polypharmacy, with usage of more than five medications, was found at 2.1% of the patients in the ANP group and in 1.9% of the patients in the GP group (p=0.92).[32] A significant difference between multimorbidity rates was found, 15% of the ANP group and 20.7% of the GP group had multimorbidity with the presence of two or more chronic illnesses (p<0.01). After performing the selection method, including only patients within the ANP scope-of-practice, only the proportion of gender changed and became not significantly different anymore, all other variables did not change.

Most prevalent diagnostic ICPC-codes

In both groups, the acute upper respiratory infection was the most prevalent recorded diagnostic code with 3.5% of the patients from the ANP group and 1.8% of the GP group. Skin, respiratory and musculoskeletal illnesses were in both groups the most common codes. Notable is that the diagnostic code for general abdominal pain/cramps at patients in the GP group is seen often, but that the ANP is rarely coding it. On the other hand, the code elderly care/ polypharmacy is coded often in the ANP group, but hardly at the GP. The top 15 most prevalent ICPC codes in the ANP and GP group comprehends 20.5% of the included patients. The ANP group distribution includes less variability compared to the GP group

distribution, as can be seen by the higher percentages at the ANP group(table 2). The top 50 recorded codes from the GP and ANP match 66%.

Healthcare consumption

A re-consultation at the practice within three months follow-up was registered at 657 patients (76%) in the ANP group compared to 2747 (75%) patients in the GP group. Patients in the ANP group had a mean of 2.48 (range 0-27) re-consultations at the practice and patients in the GP group a mean of 2.55 (range 0-38) re-consultations, the difference was not significant (table 3 and figure 3). The number of telephone and e-mail consultations at the ANP and GP group were also not significantly different. However, the difference at home-visits and referrals to other healthcare providers was significant (both $p<0.01$). The ANP performed more home-visits compared to the GP with 20 (2%) patients and 37 (1%) patients who were receiving an home-visit. The ANP wrote 26 (3%, range 0-5) referrals and the GP 337 (9%, range 0-9), which was significantly less. Only one out-of-hours contact at one patient from the GP group was recorded.

Discussion

This research shows that there is no difference in number of re-consultations at three months follow-up at the primary healthcare practice after patients have visited initially either an ANP or GP for comparable illnesses. This is also the case for telephone and e-mail consultations, however, a difference in home-visits (more visits at the ANP group) and referrals (fewer referrals at the ANP group) has been observed. Patients who visited an ANP are more often younger and have less chronic morbidities and multimorbidity compared with patients who visit the GP.

This research had several strengths, a strength of this study is that it had the possession of data from three general practices with a total of 22160 registered patients. Of these registered patients 36% visited the healthcenter during the three months study period. This can be considered as a good coverage of the primary care population, as annually 78% of the registered patients are visiting a GP.[41]

The healthcenters are registering health records with an electronic health record which resulted in automated study data. Routine care data relies heavily on correct coding. As the study took place at an academic healthcare center, the staff is used to perform research, having researchers using their data and is educated to conscientiously report their consultations. Therefore, although this study origins from routine care data, the reliability of the data can be considered good.

Another strength of this study is that it had a longitudinal design with a three months follow-up period what, compared to previous research, is fairly long. A three month follow-up period has been considered as a good timeframe to include the acute phase as well as the long-term healthcare consumption.[35]

A relative frequency distribution has been chosen in order to be able to distinguish the similarities and differences in healthcare consumption at patients with diagnostic codes within the ANP scope-of-practice. An alternative would be to use the preset list of income complaints that the practice assistants are using to triage patients for an ANP of GP consultation. However, there has been deliberately chosen for this backward selection method because the aim was to study unmanipulated what the diagnostic codes are that the ANP sees in comparison with the GP. A local preset list of income complaints would not have been effective. Consequently, this can be considered as a strength of this study.

There were also limitations, the first is marking the first patient consultation as 'index-consultation' and all subsequent consults as follow-up consultations. However, it might be

that this first consult is not the start of an episode of care. It might be that the follow-up healthcare consumption does not result from the health problem in the index-consult, but from another, previous or future health problem. To only mark the start of a new episode of care as the index-consultation was, unfortunately, not possible in this routine care database study. On the other hand, this method also has benefits, as a consult for one health problem could result in other consultations for other health problems.

The second limitation is that only three ANP's compared to 15 GP's could be included in this study and their average years of experience of the ANP's does not reflect the average GP's years of experience which also can cause bias. However, this ratio is common practice in primary care and reflects the current state of affairs. So far, only 10% of the ANP's workforce in the Netherlands is working in primary care as this profession is still developing, the numbers of ANP's as well as the average years of experience will continue to rise.[9] For future research and as the ANP workforce grows, it would be recommended to study more and more experienced ANP's.

One of the ANP's was involved in a proactive care program for elderly and sees elderly in a nursing home and therefore performed several (preventive) home-visits. As the GP's are not involved in these home-visits, this might explain the higher number of home-visits at ANP patients.

And last, due to only one recorded contact from one patient, the number of out-of-hours consultations could not be tested. It is unknown why only one contact was recorded. It could be because the ANP predominantly sees less complex illnesses and these illnesses induce not so much complaints that an out-of-hours GP consult is required. On the other hand, research shows that patients with less complex illnesses visit increasingly more the out-of-hours GP service.[14,42]

Previous systematic reviews and studies did not find a difference in number of re-consultations or referrals to other healthcare providers at primary care patients who visited an ANP compared to a GP. [21,43] These studies had various follow-up times and had ANP's working in different roles both in primary and secondary care. Most studies had a follow-up of two weeks, a few for one year. The ANP was either the fully primary healthcare provider[13] or, the study was not based on ANP's but on nurses with extra courses.[44,45] This new study adds information that ANP's can help reduce referrals towards other healthcare professions, referrals that might be medically unnecessary.[26] Unnecessary referrals are a major expense for the healthcare system, they are often written to reassure the patient or due to the healthcare provider's perceived deficient of knowledge.[46] A possible explanation for fewer referrals in the ANP group might be that ANP's are providing more health education and self-management advice which comforts and reassures the patient and might reduce medical

unnecessary referrals.[47] Previous studies also shows that ANP's are more adherent to protocols and therefore write fewer referrals when it isn't strictly medical necessary.[47,48]

In the top 50 most prevalent ICPC codes 66% of the ANP and GP registered codes match. This study confirms previous research in the out-of-office GP service that there is a lot of overlap in recorded ICPC-codes between the ANP and GP (75% was found in Biezen et al).[14] This research has not proven that all these 66% of patients consultations can be performed by an ANP. More research is necessary to find the ideal ANP:GP workforce ratio.

In this study, the patient characteristics of the ANP group differed significantly from the GP group. This implies that even though the ANP and GP are seeing patients with comparable diagnostic codes, the patients are not comparable. The patients in the GP group suffered more often from chronic morbidities and multimorbidity compared with patients in the ANP group. As multimorbidity can increase healthcare consumption it might be that this has created bias in this study.[49,50] In another Dutch research at an out-of-hours GP-service, the ANP's could choose their own patients from a list.[14] This study also found that GP's more often see older patients with higher complexities. In this current study the practice assistants triaged to which healthcare provider the patient went, but also the patient's prevalence might have been influential. Patients may prefer an appointment at short notice and can, therefore, have a preference for the ANP, who is more often quickly available[15,16]. But patients also want to see a small number of healthcare providers and therefore might have a prevalence for their familiar GP. Especially if these patients see their GP's more often for their chronic illnesses, it might be that these patients want to see the GP for low complexity illnesses as well. Previously performed research showed a good patient acceptability of ANP's in primary care, but the influence between patient characteristics and acceptability has not been studied yet.[15,51]

This study shows that substitution of care from the GP to the ANP in primary care results in the same number of consultations at three months follow-up in both patient groups. Patients in the ANP group received fewer referrals to other healthcare providers compared to patients in the GP group. Although patients in the ANP and GP group have the same number of consultations, the patients in the GP group tend to be older, have more chronic diseases and had more often multimorbidity. Further research should focus on the association of different patient characteristics of patients who visit an ANP or GP and the healthcare consumption that results from this and the ideal ANP:GP workforce ratio.

References

1.   Schäfer WLA, Boerma WGW, Kringos DS, De Ryck E, Greß S, Heinemann S, et al. Measures of quality, costs and equity in primary health care instruments developed to analyse and compare primary care in 35 countries. Qual Prim Care. 2013;21(2):67–79.

2.   Schäfer W, van den Berg M, Groenewegen P. Workload of Dutch general practitioners from an international perspective. Huisarts Wet. 2016;59(3):94–101.

3.   Baird B, Charles A, Honeyman M, Maguire D, Das P. Understanding pressures in general practice. London; 2016.

4.   Mohr DC, Benzer JK, Young GJ. Provider workload and quality of care in primary care settings: moderating role of relational climate. Med Care. 2013 Jan;51(1):108–14.

5.   Scheffler R, Liu J, Y K, Poz M. Forecasting the global shortage of physicians: an economic- and needs-based approach. Bull World Health Organ. 2008;86(7):516–23.

6.   Stichting Kwaliteit en Ontwikkeling Huisartsenzorg, Meetpunt Kwaliteit. De verpleegkundig specialist in de eerste lijn. 2015.

7.   DiCenso A, Auffrey L, Bryant-Lukosius D, Donald F, Martin-Misener R, Matthews S, et al. Primary health care nurse practitioners in Canada. Contemp Nurse. 2007 Aug;26(1):104–15.

8.   DiCenso A, Matthews S. Report on the Integration of Primary Health Care Nurse Practitioners into the Province of Ontario. Queen's printer for Ontario,CANADA. Ontario; 2005.

9.   Noordzij Francisca van der Velde E. Alumni van de Masteropleidingen tot verpleegkundig specialist Alumni van de tweejarige opleiding MANP en de driejarige categorale opleiding GGZ-VS [Internet]. Nieuwegein; 2016 [accessed 2017 Dec 6]. Available from: http://www.capaciteitsorgaan.nl/wp-content/uploads/2016/06/201606-Alumni-masteropleidingen-VS-2016-DEF.pdf

10.   Bryant-Lukosius D, Spichiger E, Martin J, Stoll H, Kellerhals SD, Fliedner M, et al. Framework for Evaluating the Impact of Advanced Practice Nursing Roles. J Nurs Scholarsh. 2016;48(2):201–9.

11.   Ingersoll GL, McIntosh E, Williams M. Nurse-sensitive outcomes of advanced practice. J Adv Nurs. 2000;32(5):1272–81.

12.   Brooten D, Youngblut JAM, Deosires W, Singhala K, Guido-Sanz F. Global considerations in measuring effectiveness of advanced practice nurses. Int J Nurs Stud. 2012;49(7):906–12.

13.   Hemani A, Rastegar DA, Hill C, Al-Ibrahim MS. A comparison of resource utilization in

nurse practitioners and physicians. Eff Clin Pract. 1999;2(6):258–65.

14. van der Biezen M, Schoonhoven L, Wijers N, Van Der Burgt R, Wensing M, M L, et al. Substitution of general practitioners by nurse practitioners in out-of-hours primary care: a quasi-experimental study. J Adv Nurs. 2016;72(8):1813–24.

15. Dierick-van Daele ATM, Spreeuwenberg C, Derckx EWCC, van Leeuwen Y, Toemen T, Legius M, et al. The value of nurse practitioners in Dutch general practices. Qual Prim Care. 2010;18(4):231–41.

16. Kinnersley P, Anderson E, Parry K, Clement J, Archard L, Turton P, et al. Randomised controlled trial of nurse practitioner versus general practitioner care for patients requesting "same day" consultations in primary care. BMJ. 2000;320(7241):1043–8.

17. Venning P, Durie A, Roland M, Roberts C, Leese B. Randomised controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care. BMJ. 2000 Apr;320(7241):1048–53.

18. Mundinger MO, Kane RL, Lenz ER, Totten AM, Tsai WY, Cleary PD, et al. Primary care outcomes in patients treated by nurse practitioners or physicians: a randomized trial. JAMA. 2000 Jan;283(1):59–68.

19. Horrocks S, Anderson E, Salisbury C. Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors. BMJ. 2002;324(7341):819–23.

20. Laurant MGH, Hermens RPMG, Braspenning JCC, Sibbald B, Grol RPTM. Impact of nurse practitioners on workload of general practitioners: randomised controlled trial. BMJ. 2004 Apr;328(7445):927.

21. Swan M, Ferguson S, Chang A, Larson E, Smaldone A. Quality of primary care by advanced practice nurses: a systematic review. Int J Qual Heal care J Int Soc Qual Heal Care. 2015 Oct;27(5):396–404.

22. Newhouse RP, Stanik-Hutt J, White KM, Johantgen M, Bass EB, Zangaro G, et al. Advanced practice nurse outcomes 1990-2008: a systematic review. Nurs Econ. 2011;29(5):230–50.

23. Dierick-Van Daele A, Metsemakers J, Derckx E, Spreeuwenberg C, Vrijhoef H. Nurse practitioners substituting for general practitioners: randomized controlled trial. J Adv Nurs. 2009;65(2):391–401.

24. Martin-Misener R, Harbman P, Donald F, Reid K, Kilpatrick K, Carter N, et al. Cost-effectiveness of nurse practitioners in primary and specialised ambulatory care: systematic review. BMJ Open. 2015 Jun;5(6):e007167.

25. Dierick-van Daele A, Steuten L, Metsemakers J, Derckx E, Spreeuwenberg C, Vrijhoef H. Economic evaluation of nurse practitioners versus GPs in treating common conditions. Br J Gen Pract. 2010;60(570):e28-35.

26. van der Biezen M, Adang E, Van Der Burgt R, Wensing M, Laurant M. The impact of substituting general practitioners with nurse practitioners on resource use, production and health-care costs during out-of-hours: a quasi-experimental study. BMC Fam Pract. 2016;17(1):132.

27. DiCenso A, Bryant-Lukosius D, Martin-Misener R, Donald F, Abelson J, Bourgeault I, et al. Factors enabling advanced practice nursing role integration in Canada. Nurs Leadersh (Tor Ont). 2010 Dec;Spec No 20(sp):211–38.

28. Sedgwick P. Prospective cohort studies: advantages and disadvantages. BMJ. 2013 Nov 8;347(nov):f6726–f6726.

29. Grobbee DE, Hoes AW. Clinical Epidemiology. Second. Burlington: Jones & Bartlett Learning; 2015.

30. Polit D, Beck C. Nursing research, Generating and Assessing Evidence for Nursing Practice. Tenth edit. China: Wolters Kluwer; 2017.

31. Lamberts H, Wood M. ICPC. International Classification of Primary Care. Oxford: Oxford University Press; 1987.

32. Verduijn M, Leendertse A, Moeselaar A, De Wit N, Van Marum R. Multidisciplinaire richtlijn Polyfarmacie bij ouderen. Huisarts Wet. 2013;56(8):414–9.

33. Oostrom SH Van, Picavet HSJ, Gelder BM Van, Lemmens LC, Hoeymans N, Verheij R a, et al. Multimorbiditeit en comorbiditeit in de Nederlandse bevolking – gegevens van huisartsenpraktijken. Ned Tijdschr Geneeskd. 2011;155:1–7.

34. Valderas JM, Starfield B, Sibbald B, Salisbury C, Rloand M. Defining comorbidity: implications for understanding health and health services. Ann Fam Med. 2009;7:357–63.

35. Heinonen J, Koskela TH, Soini E, Ryynänen OP. Primary-care-based episodes of care and their costs in a three-month follow-up in Finland. Scand J Prim Health Care. 2015;33(4):283–90.

36. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013 Nov 27;310(20):2191–4.

37. Dixon JR. The International Conference on Harmonization Good Clinical Practice guideline. Qual Assur. 1998;6(2):65–74.

38. Burgerlijk Wetboek Boek 7, Afdeling 5 [Internet]. [accessed 2017 Nov 8]. Available from: http://www.ccmo.nl/attachments/files/wgbo-pdf.pdf

39. Overheid.nl. Personal Data Protection Act [Internet]. 2017 [accessed 2017 Dec 10]. Available from: http://wetten.overheid.nl/BWBR0011468/2017-07-01

40. Vereniging van Universiteiten (VSNU). De Nederlandse Gedragscode Wetenschapsbeoefening. 2014. p. 0–11.

41. NIVEL. Omvang zorggebruik | NIVEL [Internet]. [accessed 2018 Jun 19]. Available from: https://www.nivel.nl/nl/nzr/zorgverlener/huisarts/omvang-zorggebruik

42. Nørøxe KB, Huibers L, Moth G, Vedsted P. Medical appropriateness of adult calls to Danish out-of-hours primary care: A questionnaire-based survey. BMC Fam Pract. 2017;18(1):1–9.

43. Martínez-González N, Rosemann T, Tandjung R, Djalali S. The effect of physician-nurse substitution in primary care in chronic diseases: a systematic review. Swiss Med Wkly. 2015 Feb 4;145.

44. Shum C, Humphreys A, Wheeler D, Cochrane MA, Skoda S, Clement S. Nurse management of patients with minor illnesses in general practice: multicentre, randomised controlled trial. BMJ. 2000 Apr;320(7241):1038–43.

45. Iglesias B, Ramos F, Serrano B, Fàbregas M, Sánchez C, García MJ, et al. A randomized controlled trial of nurses vs. doctors in the resolution of acute disease of low complexity in primary care. J Adv Nurs. 2013;69(11):2446–57.

46. Ringberg U, Fleten N, Førde OH. Examining the variation in GPs' referral practice: a cross-sectional study of GPs' reasons for referral. Br J Gen Pract J R Coll Gen Pract. 2014 Jul;64(624):e426-33.

47. Seale C, Anderson E, Kinnersley P. Treatment advice in primary care: A comparative study of nurse practitioners and general practitioners. J Adv Nurs. 2006;54(5):534–41.

48. Lovink MH, Persoon A, Koopmans RTCM, Van Vught AJAH, Schoonhoven L, Laurant MGH. Effects of substituting nurse practitioners, physician assistants or nurses for physicians concerning healthcare for the aging population: a systematic literature review. J Adv Nurs. 2017 Mar 16;

49. McPhail SM. Multimorbidity in chronic disease: impact on health care resources and costs. Risk Manag Healthc Policy. 2016 Nov;9:143–56.

50. Hopman P, Heins MJ, Korevaar JC, Rijken M, Schellevis FG. Health care utilization of patients with multiple chronic diseases in the Netherlands: Differences and underlying factors. Eur J Intern Med. 2016;35:44–50.

51. Parker R, Forrest L, Ward N, McCracken J, Cox D, Derrett J. How acceptable are primary health care nurse practitioners to Australian consumers? Collegian. 2013;20(1):35–41.
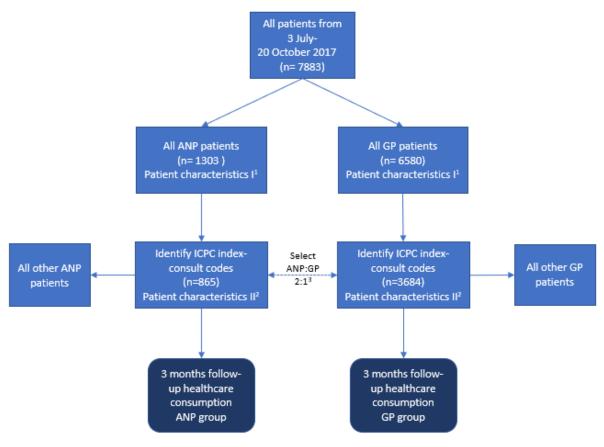
Figure 1   Flow diagram of the study

[1] Patient characteristics I include all patients who had a consultation with an ANP or GP during the inclusion period

[2] Patient characteristics II include all selected patients (ANP and GP) within the ANP scope-of-practice

[3] A joint relative frequency distribution has been made with the index-consult ICPC diagnostic codes with an ANP:GP ratio of 2:1 with the aim to predominantly include patients with illnesses within the ANP scope-of-practice. This method has been combined with a minimum of three patients per illness and discipline. Illnesses and therefore patients below this minimum were excluded.

Table 1   Patient characteristics

	All patients patient characteristics I[1]			Included patients patient characteristics II[2]		
	ANP (n=3, 2,1 FTE)	GP (n=14, 8.2FTE)	p-value	ANP (n=3, 2,1 FTE)	GP (n=14, 8.2FTE)	p-value
Patients, n	1303	6580		865	3684	
Female (%)	53.6	59.3	<0.01[6]	54.7	57.9	0.09[6]
Age, years, median (range)	32 (0-96)	36 (0-96)	<0.01[7]	31 (0-94)	35 (0-96)	<0.01[7]
0-4 (%)	15	8		16	9	
5-14 (%)	13	13		14	15	
15-24 (%)	7	10		7	10	
25-44 (%)	39	34		38	33	
45-64 (%)	16	25		15	24	
65-74 (%)	5	6		5	6	
75+ (%)	5	4		4	3	
Polypharmacy[3], %	2.1	1.9	0.71[6]	1.7	1.7	0.92[6]
Chronic morbidities[4], mean (range)	5.2 (0-10)	6.7 (0-14)	0.05[7]	0.66 (0-10)	0.84 (0-14)	<0.01[7]
Multimorbidity[5], (%)	15.7	20.7	<0.01[6]	13.8	19.4	<0.01[6]

[1] Patient characteristics I include all patients who had a consultation with an ANP or GP during the inclusion period

[2] Patient characteristics II include all selected patients (ANP and GP) within the ANP scope-of-practice

[3] ≥5 chronic medications

[4] Chronic morbidities derived from Oostrom et al[33]

[5] ≥ 2 chronic morbidities
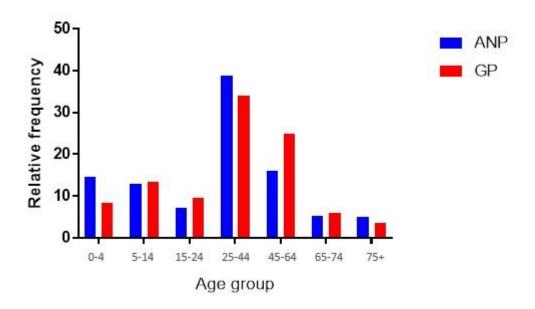
[6] Chi-square

[7] Mann-Whitney U

Figure 2   Age per healthcare provider grouped in seven commonly used age groups.

Table 2   Top 15 ICPC codes

Top 15 ICPC diagnoses per healthcare provider

unmatched

	ANP n=1303		GP n= 6580	
		n (%)		n (%)
1	R74 - Upper respiratory infection acute	45 (3,5%)	R74 - Upper respiratory infection acute	119 (1,8%)
2	R05 - Cough	33 (2,6%)	A97 - No disease[1]	118 (1,8%)
3	S74 - Dermatophytosis	30 (2,4%)	S74 - Dermatophytosis	110 (1,7%)
4	H70 - Otitis externa	28 (2,2%)	A04 - Weakness/tiredness general	108 (1.7%)
5	A97 - No disease[1]	24 (1,9%)	R05 - Cough	97 (1.5%)
6	S84 - Impetigo	21 (1,7%)	L17 - Foot/toe symptom/complaint	82 (1.3%)
7	A49 - Elderly care/ polypharmacy	21 (1,7%)	S99 - Skin disease, other	76 (1.2%)
8	L03 - Low back symptom/complaint	20 (1,6%)	L99 - Musculoskeletal disease, other	74 (1.1%)
9	L99 - Musculoskeletal disease, other	19 (1,1%)	L04 - Chest symptom/complaint	74 (1.1%)
10	H71 - Otitis media acuta/myringitis	19 (1,5%)	S88 - Dermatitis contact/allergic	73 (1.1%)
11	S87 - Dermatitis/atopic eczema	17 (1,3%)	L15 - Knee symptom/complaint	72 (1.1%)
12	F72 - Blepharitis/ hordeolum/chalazion	16 (1,3%)	S87 - Dermatitis/atopic eczema	69 (1.1%)
13	A04 - Weakness/tiredness general	15 (1,2%)	S82 - Naevus/mole	69 (1,1%)
14	R96 - Asthma	15 (1,2%)	D01 - Abdominal pain/cramps general	69 (1,1%)
15	L81 - Injury musculoskeletal NOS	15 (1,2%)	L08 - Shoulder symptom/complaint	68 (1,1%)

[1] No disease includes children's wish and preventive consultations such as vaccinations but has also been used as an alternative if there is no diagnostic illness code appropriate, but a code is mandatory for saving in the electronic health records.

Table 3 Healthcare consumption

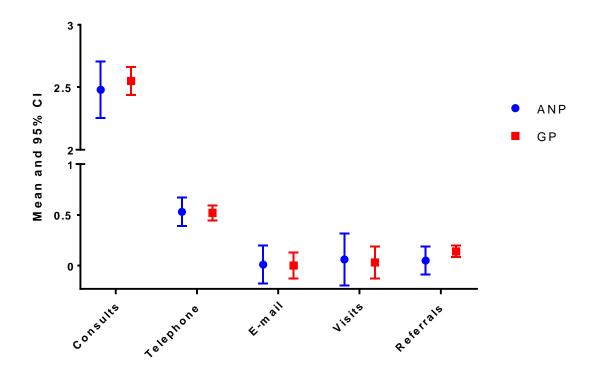|	ANP n= 865		GP n= 3684		p-value
	n (%)	mean (range)	n (%)	mean (range)	
Re-consultation	657 (76%)	2.48 (0-27)	2747 (75%)	2.55 (0-38)	0.772
Home-visits	20 (2%)	0.06 (0-13)	37 (1%)	0.03 (0-17)	<0.01
Telephone	252 (29%)	0.53 (0-14)	1048 (28%)	0.52 (0-16)	0.652
E-mail	4 (0.4%)	0.00 (0-3)	6 (0.2%)	0.00 (0-6)	0.23
Out-of-hours GP contacts	0 (0%)		1 (0%)		NA[1]
Referrals to other healthcare providers	26 (3%)	0.05 (0-5)	337 (9%)	0.14 (0-9)	<0.01

[1]To few events to calculate a p-value

Figure 3 Mean consultations and 95% CI